FUN WITH NATURAL SCIENCE

GRADE 6

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Recommended by the NSW Primary Textbook Reviewing Committee

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EDITOR'S NOTE

TO THE TEACHER.

This book, as were the previous books in this series, is essentially a work book for the individual child.

The material, experimental work and language should be within the ability and interest of the 6th Grade student and properly completed it will provide an adequate record of work done, problems solved and conclusions reached.

While an amount of information is provided, this will need supplementing by reference to the various sources suggested in the Natural Science Syllabus. Experience has shown that the interest aroused leads the child to seek further information in the school library. Some sections in this book are extensions of material presented in the earlier books in this series so, consequently, reference to these will be necessary in some cases.

There may be more material than can be comfortably handled in the classroom but the arrangement of the work will make it possible for much of the work to be done individually and as home exercises. In fact some of the work will have to be done at home.

There is a small amount of repetition of work included in the previous book. This was essential so that satisfactory starting places could be obtained. It will provide useful revision for those who have worked through the previous book.

Emphasis should at all times be placed on accuracy in observation and recording as such is fundamental to the development of a scientific attitude.

Owen Martin,

Editor.

SOME THINGS TO REMEMBER

COLLECTING SPECIMENS

Be careful when collecting specimens.

Animals must protect themselves and some can be dangerous. This is particularly so in the case of some insects and spiders. If you do not KNOW an animal, DO NOT HANDLE IT. If it is small enough, shake it or push it into a bottle or tin.

If you want to study it more closely your teacher may make a "killing-bottle" and kill the animal painlessly.

If you want to study the life of some insect, make an INSECTORIUM as it is suggested in the Fourth Grade Book.

Do not keep specimens unnecessarily. If you are making a collection of shells or insects or other specimens, see that it is properly displayed and that everything is properly labelled. Throw specimens out when they are no longer needed.

Always collect pictures or make NEAT, ACCURATE drawings of the animals you study. Label all drawings.

FORCE, WORK and ENERGY

When we PUSH or PULL or TURN something we use FORCE.

If we move the thing we do WORK.

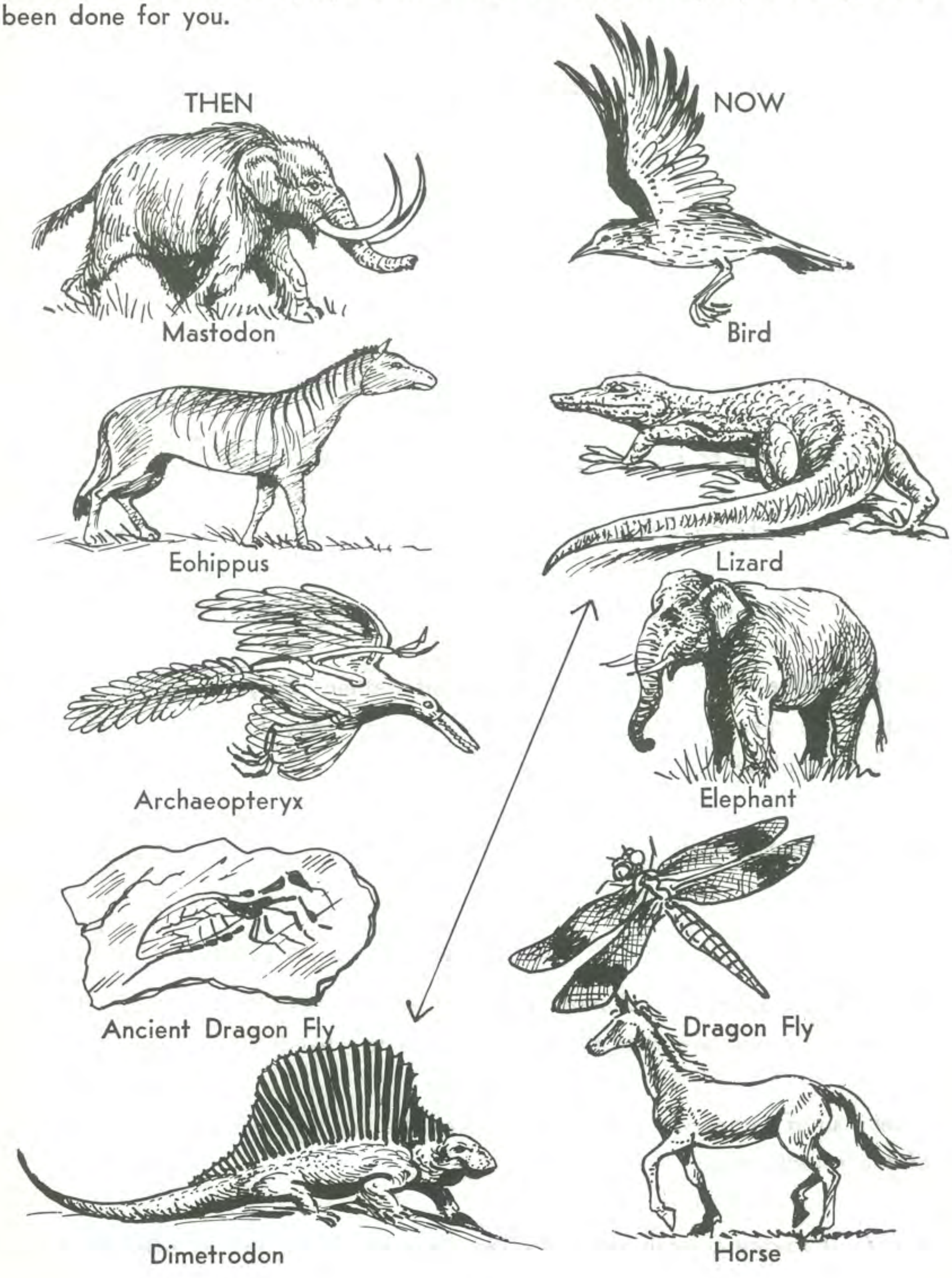
The ability to do work is ENERGY.

ENERGY may be in different forms.

We can change one form of ENERGY into another.

ANIMALS THEN AND NOW

Match these animals of long ago with their relatives of to-day, by drawing arrows. One has been done for you.



You can see that many animals of long ago were similar to animals now, but there have been some changes.

The Mastodon had a hairy covering; the Elephant has not.

The Archaeopteryx had teeth; A modern bird has ....teeth.

The Eohippus was about 40 centimetres high and had four toes on each foot. The Horse is about...............high and has...............toe on each foot.

The ancient Dragon-fly was about 60 cm across. A modern Dragon-fly is about .... centimetres across.

If we compare some plants of long ago with plants of to-day we will find similar changes.

The change in the form of plants and animals is called EVOLUTION.

For millions of years life has been changing and improving. It is believed that life started with tiny sea-creatures. These improved and became more complex. (Look up that word in a dictionary.) After millions of years we have the many kinds of life that we have now.

In the changes, some forms of life disappeared altogether. They became EXTINCT. You have heard of the giant reptiles which lived long ago. They became extinct and other animals took their place.

Name some of these animals..

....

Evolution is still going on. The changes are so slow that we do not notice them. We know that men are taller now than they were even a few hundreds of years ago.

Only a small man of to-day would be able to wear the biggest suit of armour worn by a Knight of the Middle Ages.

Boys and girls of to-day are taller and stronger than boys and girls of fifty years ago.

WHAT CAUSES EVOLUTION?

Scientists are still not exactly sure what causes evolution. We do know that the babies of any plant or animal are never exactly like their parents.

Compare yourself with your Mother or Father.

Is your hair the same colour? ....

Are your eyes the same colour? ....

Is your nose the same shape? ....

Are your ears the same shape? ....

Is your chin the same shape? ....

See if you can find some other differences.

....

....

See if you can find some differences between a mother cat and her kittens or a she-dog and her puppies. ....

....

One reason for the differences is that babies have two parents and they inherit (look this word up) some features from each parent. Sometimes they inherit features from further back. If both your parents are short and you are tall you will probably find that some of your grandparents were tall.

This explains HOW things can change. It does not explain WHY they change.

Animals and plants must be suited to the conditions in which they live. The scientist says they must be "adapted to their environment".

If conditions change the living things must change too, or they will die out.

The giant reptiles of long ago lived in swamps. The swamps kept them cool, provided them with food and partly helped to support their great weight. A change in climate caused the swamps to dry up. The reptiles were not adapted to their new environment, so they died out.

The animal or plant most suited to the conditions has the best chance of surviving.

Some scientists believe that radiation from space causes changes so that a baby plant or animal is born which is slightly different from the other plants and animals of its kind. If this change makes it better adapted to its environment, the change will stay. This change is called a MUTATION.

A baby giraffe was born with a longer neck than other baby giraffes. The longer neck was useful to get leaves from high trees, so this giraffe grew bigger and stronger than others of its kind. When food was scarce, it survived when the others died. Its babies had longer necks and got more food, so that gradually all giraffes had long necks, because the others could not survive.

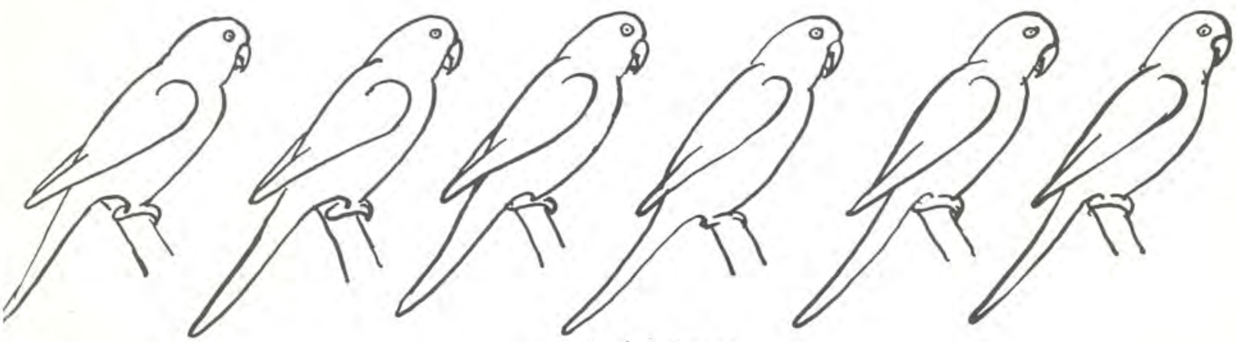
All this is rather difficult to understand, but don't worry; scientists don't really understand it either.

HURRYING UP EVOLUTION

Evolution takes a very long time. Scientists have found ways of hurrying evolution up so that they can breed better plants and animals.

You remember that babies inherit features from each of their parents. By picking the right sort of parents it is possible to make sure that the babies will inherit certain features. Perhaps you breed budgerigars or you know some-one who does. If so you will know that there are many colours of budgerigars.

Colour these budgerigars in some of the different colours you have seen. Make sure that they are the right colours.



Budgerigars

The wild budgerigars are mainly green and yellow. The other coloured birds have been obtained by breeding.

If you want to breed a bright blue budgerigar, you will breed from a cock-bird and a hen-bird that are a little bluer than other birds.

At least one of their babies will be bluer than either of its parents. You breed this with another bluish bird and so on. If all goes well, you will finish up with a bright blue budgerigar.

It takes a long time but it is still quicker than nature.

Farrer did something similar when he bred new varieties of WHEAT. He wanted a good yielding wheat with a strong stem. He crossed a wheat that yielded well but had a weak stem with a wheat that was a poor yielder but had a strong stem. After years of crossing and recrossing he finally got what he wanted.

This was not all Farrer did to improve wheat by breeding. Read about him and write down some of the other things he did.

....

....

Read about Luther Burbank too. He was the greatest plant breeder of all. Some of the things he did were almost miracles.

Name some of them. ....

....

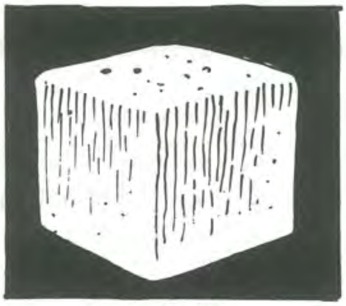
By breeding we have evolved sheep that give more wool, cows that give more milk, hens that lay more and larger eggs, trees which produce timber more quickly, fruit trees which produce more and larger kinds of fruit, and even fruit which nature did not evolve.

Many of the scientists who work for the C.S.I.R.O. are carrying out research to improve plants and animals. Find out what these letters stand for. C.............................. S..............

and I.......................... R............................ O......................

The Forestry Commission does breeding research too. What do you think it is interested in?

SOLIDS, LIQUIDS and GASES



Ice—Solid

Water—Liquid

Water-vapour—Gas

Almost all substances are SOLIDS, LIQUIDS or GASES.

Place each of these under its proper heading: wood, iron, nitrogen, petrol, "dry ice", carbon-dioxide, mercury, rock, oxygen, methylated spirits, oil, vinegar, salt, coal-gas, treacle.

SOLIDS	LIQUIDS	GASES

When water boils it changes to.................................

Water — heat energy → water vapour.

Liquid — heat energy → gas.

A burn from steam is worse than a burn from boiling water. Why?....................................

....

When water-vapour cools it changes to....................................

Water-vapour — heat energy → water.

Gas — heat energy → liquid.

When water becomes very cold it changes to....................................

Ice is the solid form of water.

When ice is heated it .... and changes to ....

Water — heat energy → ice.

Liquid — heat energy → solid.

Ice + heat energy → water.

Solid + heat energy → liquid.

Many solids can be changed into liquids if we give them enough heat.

Have you ever made your own fishing sinkers?

What did you do to the lead? ....

What happened to it? ....

What happened when it cooled? ....

Have you ever been to a steel-works? ....

If so, you know how hot iron must be before it melts.

Do you know what "dry-ice" is? It is solid carbon-dioxide. It takes in heat and changes to carbon-dioxide gas. It changes from solid to gas without forming a liquid first.

Some liquids take in heat easily and change to gases.

What happens if you leave the cork out of a bottle of methylated spirits or petrol or perfume? ....

Where have the liquids gone? ....

How do you know they are in the air? ....

Why is it dangerous to leave an open bottle of petrol or methylated spirits in a place where there is a flame? ....

....

When solids melt or liquids evaporate they take heat from the surrounding objects.

EXPLAIN:

(a) Why does "dry-ice" keep ice-cream so hard?

....

(b) Why does a drop of methylated spirits on your hand feel cold?

....

(c) Why does perspiring make you feel cool?

....

ENERGY FROM FOOD

Plants store energy from the sun in the food they make. They store it as STARCH, SUGAR, or FAT. When animals eat food they are able to make use of this stored energy.

Starch and sugar are Carbohydrates. Carbohydrates are made from carbon and water joined together.

Carbon is usually a black substance. You may know it as coal, charcoal or pencil lead; but diamonds are also carbon.

You cannot make Carbohydrates by mixing carbon and water. They have to be joined in a very special way. At present only plants can do this.

STARCH is the white substance mother uses to stiffen clothes but is also found in many foods. Here is how you can find out if a food contains starch.

Experiment F1. Make a little starch paste by mixing a teaspoonful of starch with a little cold water and then adding hot water till the starch has a glassy look.

Add one drop of TINCTURE OF IODINE and stir. What happens?

TESTING FOR STARCH

Iodine always turns cooked starch dark-blue, and so, if we get this blue colour with iodine we know the food contains STARCH.

Test these foods for starch. Underline the ones that do contain starch. The test works best with cooked foods. It is best to use iodine mixed with water [about two parts of water to one of iodine].
Test: Potatoes, bread, rice, tapioca, salt, sugar, egg-white, cornflour, milk, cheese, butter.

SUGAR. It is not easy to test properly for sugar. The test needs chemicals which are poisonous and can be dangerous. Most things which contain sugar are at least slightly sweet.

Experiment F2. Taste a little of each of the following substances and underline the ones you think contain sugar.

Raisins, toffee, apples, grapes, tomatoes, carrots, honey, milk, beetroot, dates.

Not all sweet things have sugar in them. Perhaps you can find one sweet thing that has no sugar.

FATS. Butter and lard are solid fats. Olive oil and peanut oil are liquid fats or OILS.

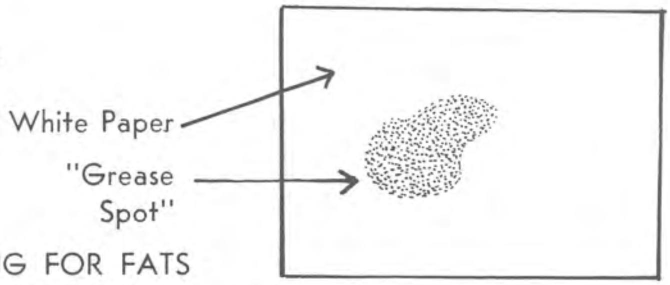
Experiment F3. Smear a piece of white paper with butter. Hold the paper up to the light.

What do you notice?

Where the butter is on the paper it lets the light through.

We say it is TRANSLUCENT.

This is a test for fats and oils.



TESTING FOR FATS

Try the experiment with lard, peanut butter, olive oil, chopped nut, margarine, fish, milk, bacon fat, cocoa.

Underline those you think contain fat or oil.

Carbohydrates are the main energy and heat giving foods.

Who needs the most carbohydrates—

(a) An old man or you?

(b) An Eskimo or an African jungle dweller?

(c) You in Summer or in Winter?

(d) A farmer or an office worker?

To use the energy the carbohydrates have to be joined with oxygen. This happens in our bodies.

Where do we get the oxygen from?

OUR OWN SPECIAL PLANTS AND ANIMALS

Australia has many animals and plants not found anywhere else in the world. Some of them have not even any relatives anywhere else.

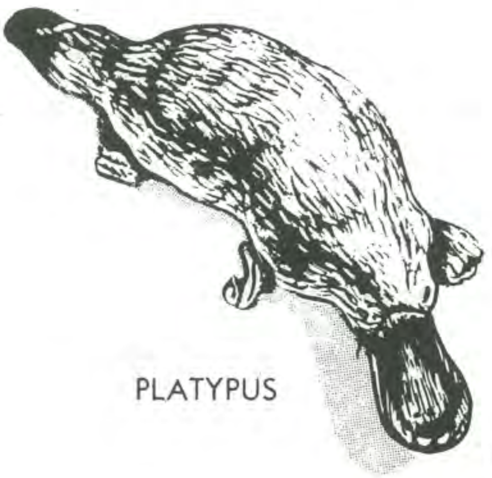
This is probably because their ancestors came from Asia, millions of years ago, when Australia and Asia were joined. Later the land sank and there was no longer a bridge between the continents.

THE LAND BRIDGE

The meat-eating animals which evolved in Asia and some other continents killed off the ancestors of the kangaroos, koalas and other animals now found in Australia. These fierce animals did not reach Australia so our animals could evolve peacefully.

SOME SPECIAL AUSTRALIAN ANIMALS

Two very interesting animals found only in Australia are the PLATYPUS and the ECHIDNA, or SPINY ANTEATER. They are MAMMALS because the mother feeds the babies on milk, but the babies hatch from eggs.



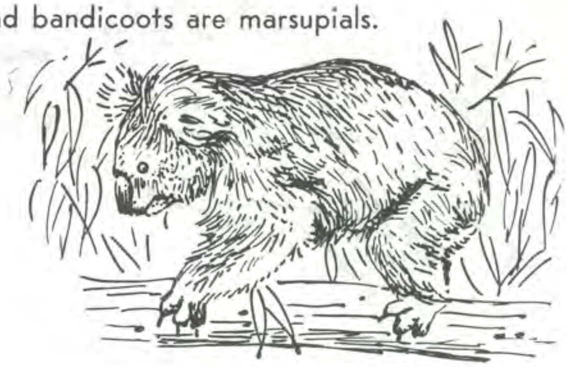
PLATYPUS

ECHIDNA

Most other Australian mammals are MARSUPIALS, or pouched animals. When the baby is born it is very tiny indeed so the mother carries it in her pouch, where it feeds and grows.

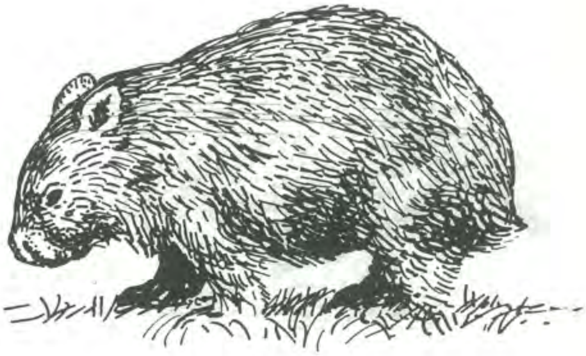
Kangaroos, wombats, koalas, possums, native cats and bandicoots are marsupials.

Kangaroo



Koala

Brushtail Possum



Wombat

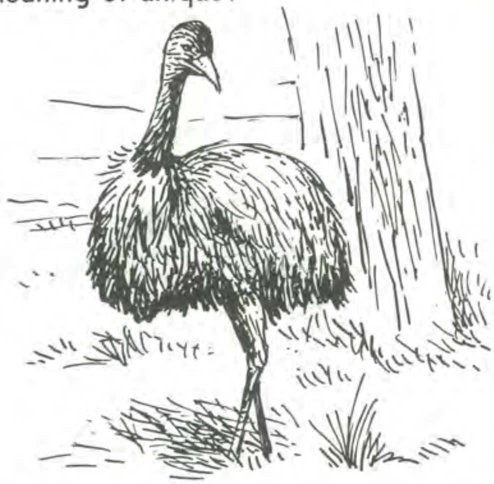
Striped Bandicoot

Tasmanian Devil

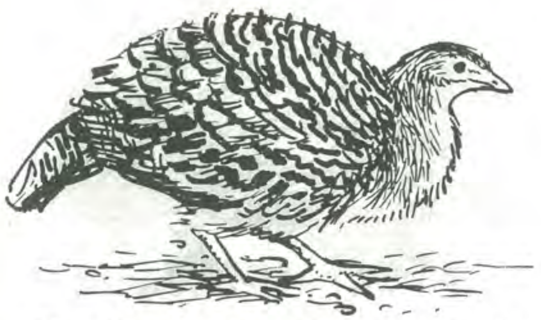
If there are any of these animals near you, find out all you can about them. If you live in Sydney, you can see most of them at the Zoo.

Some of our birds are unique, too. What is the meaning of unique?

The Lyre-bird has no relatives outside Australia.



The Emu is the second-largest bird in the world.

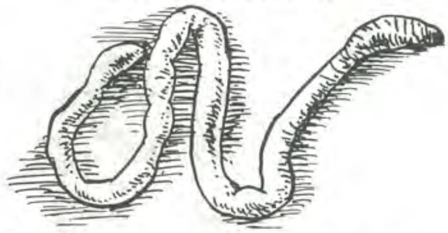


The Mallee-fowl builds a mound of earth and leaves in which to hatch its eggs.

The Satin Bower-bird builds a platform and decorates it.

There are many other interesting Australian animals.

See what you can find out about these animals:



The Queensland Lung-fish

The Gippsland Giant Earthworm

....

....

....

....

WHAT IS AIR?

You have learnt that air is a gas. This is not exactly true. Air is a mixture of several gases.

The two chief ones are OXYGEN and NITROGEN.

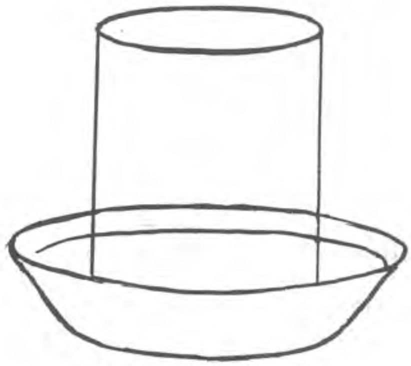
Experiment A1. Light a candle. Cover it with a large glass jar. What happens?

....

Why? ....

If you said that the air had been used up, you were not correct. ALL the air had not been used up.

Experiment A2. Float a short lighted candle fixed to a tin lid on water in a dish. Cover with a large glass jar.



Draw what happens.

What happens to the candle? ....

What happens to the water? ....

Why? ....

Is all the air used up? ....

How do you know? ....

What do you think is in the upper part of the jar? ....

....

The burning candle used up the OXYGEN. About one fifth of air is OXYGEN. The rest is mainly NITROGEN, but there is some WATER VAPOUR and CARBON-DIOXIDE.

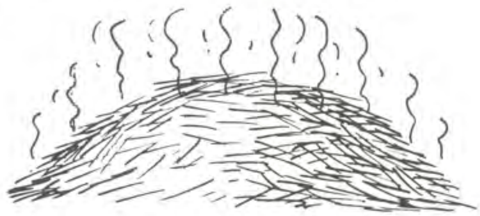
When the candle burned it combined with (joined with) oxygen to make carbon dioxide and water; and it gave out HEAT ENERGY. When a fire burns the same thing happens.

This is rapid combustion or quick burning.

When a heap of grass becomes hot something similar happens, but more slowly.

This is SLOW COMBUSTION.

In each case HEAT ENERGY is given out.



Slow Combustion

A form of slow combustion goes on in our bodies.

Carbohydrates combine with oxygen to make carbon dioxide and water and release Heat Energy.

You may remember that plants used carbon-dioxide and water and heat energy from the sun to make food in the first place.

PLANT. Carbon dioxide + water + Heat Energy → Carbohydrates.

ANIMAL. Carbohydrates → Carbon dioxide + water + Heat Energy.

All animals need OXYGEN to release energy.

Most land animals use their .... to obtain oxygen from the ....

Fish use .... to obtain dissolved oxygen from ....

Insects have neither lungs nor gills.

How do they obtain oxygen? ....

....

As long as we are alive we use some energy, but the amount we use depends on what we are doing.

Place 1 after the person likely to be using most energy, 2 after the next and so on. Everybody may not agree on the answers.

(a) A sick child ☐

(b) A bricklayer's labourer ☐

(c) A typist ☐

(d) A shop assistant ☐

(e) A mother doing housework ☐

(f) A bus driver ☐

(g) A bus conductor on a double-decker bus ☐

(h) A school-boy in the playground ☐

AUSTRALIAN PLANTS

Australia has many interesting and beautiful plants.

Perhaps the best known are the WATTLES. There are more than five hundred kinds all over Australia.

Wherever you live some kinds of Wattle will grow near you. Study them.

Draw and name a Wattle tree or a branch with leaves and flowers.	Draw and name a Eucalyptus tree or a branch with leaves and flowers.

There are 350 kinds of Eucalypts. There will be some kinds of Eucalypts growing near you so look at them.

Here are some Australian plants. UNDERLINE any that grow in your district, and add some others.

Waratah, Christmas Bells, Christmas Bush, Boronia, Bottlebrush, Desert Pea, Gymea Lily, Maidenhair Fern, Tree Fern, Staghorn, White Cedar, Kurrajong, Pepper Tree, Ti-tree, Native Daphne, She-Oak, Fig-tree, Five Corners, ..., ...,

................................., ..., ..., ...,

................................., ..., ..., ...

SAVING OUR PLANTS AND ANIMALS

We have not always been very careful in looking after our native animals and plants.

Before white men came to Australia the Aborigines lived on the native plants and animals. They were always careful not to destroy any kind completely. When food was becoming scarce in any one place they went "walk-about" and gave the animals and plants a chance to breed and recover.

White men were not always so careful. They killed animals for food but they also killed many for their skins. Thousands of Platypuses were killed to make rugs.

The early settlers cleared land to grow crops and raise animals. This was necessary but it meant that not only were many plants destroyed but many animals lost home and food. When you know that a koala eats leaves from only five kinds of eucalypt trees you will see how easily this could be done. When the settlers started to grow crops or raise animals they had to kill any animals which ate their crops or animals or destroyed fences.

They had to kill kangaroos. Why?...

Dingoes. Why?...

Wombats. Why?...

Eagles. Why?...

Galahs. Why?...

Silver-eyes. Why?...

This was necessary, but people who have studied the problem think too many animals were killed and some were killed unnecessarily. For example, some fruit eating birds also ate insects, and the insects they ate more than paid for the fruit they ate.

Some stupid things were done. Foxes were brought into the country so that some people could hunt them as they did in England. The foxes went wild and destroyed much native wild-life, particularly birds.

Rabbits were brought into the country and soon became a pest. They ate out plant life in some areas and other animals starved.

In the last few years a new danger to our wild life has appeared.

Ever since man began to grow crops he has had to struggle against pests which could harm or destroy them. In his efforts to control insect pests man has invented stronger poisons. These do kill pests, but there is a danger that they may kill other things too.

An insect poison kills all insects, even useful ones like bees. It may also kill birds and fish which feed on insects. It may kill animals which feed on birds and fish. It may kill humans. How are we going to avoid destroying our native plants and animals? We must grow food. We must clear and cultivate land. We must cut down trees. We must destroy creatures which harm our crops and animals.

You might have a class discussion on this subject.

Two things are certain. We must LEARN more and we must THINK more.

If we do not learn and think about our plants and animals we may find that some of them have disappeared altogether. Kangaroos are very numerous in the Western Districts of N.S.W. Graziers consider them pests because they eat grass needed by sheep and cattle. Hundreds are being shot by professional shooters every night. This is probably necessary, but we must be careful not to kill them all. There are so many that this seems impossible but the Americans thought that about the buffalo. At one time there were huge herds of them on the prairies but buffalo-hunters almost wiped them out.

Some kinds of wallaby have become extinct. Leadbeater's possum which was once very common in Victoria has not been seen for years. The Tasmanian tiger is almost extinct. Koalas died out in South Australia.

In 1927 600,000 koala skins were exported from Queensland but since then any further shooting has been prohibited.

Many of our most beautiful plants have become very rare in the bush. Boronia and Christmas Bush were once quite common but people picked them thoughtlessly and even dug up the roots. Often bush areas were stripped and the flowers sold by people with little thought for beauty. Now these and many other plants are protected.

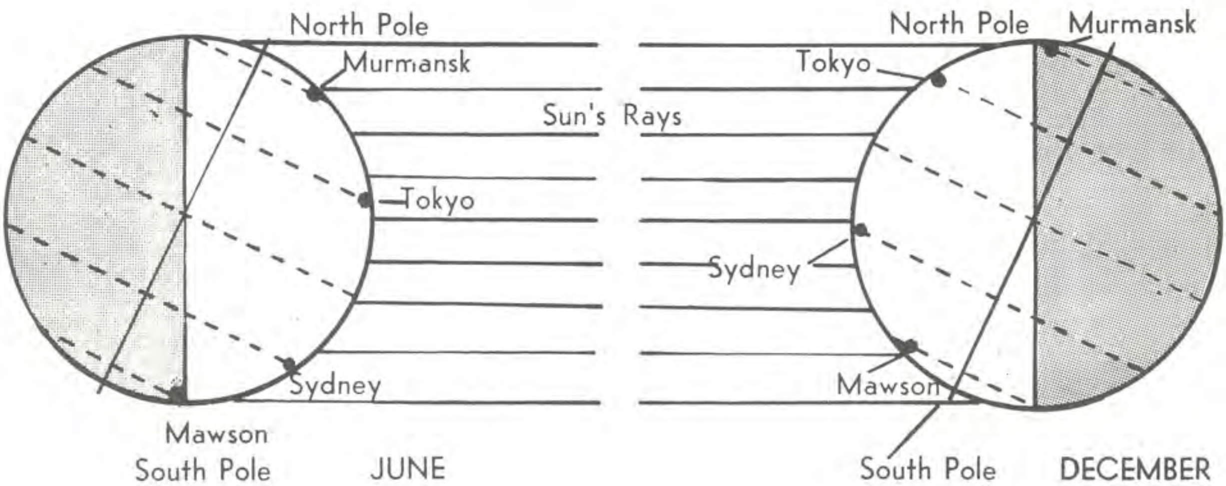
THE SEASONS

Last year you learnt that SEASONS are caused by—

(a) The.................................... of the Earth round the ....

(b) The.................................... of the Earth.

We will revise the topic briefly. If you still have last year's book I suggest you look at it again and repeat the experiments.



Look at the diagram and complete these statements.

In December the   Pole is pointing to the Sun.

Places in the Southern Hemisphere have (more/less) sunlight than places in the Northern Hemisphere.

The sunlight falls (more/less) directly in places in the Southern Hemisphere than in places in the Northern Hemisphere.

It is (Summer/Winter) in the Southern Hemisphere and (Summer/Winter) in the Northern Hemisphere.

In June the   pole is facing the sun.

Places in the Northern Hemisphere have (more/less) sunlight than places in the Southern Hemisphere.

The sunlight falls (more/less) directly on places in the Southern Hemisphere.

It is (Summer/Winter) in the Northern Hemisphere and (Summer/Winter) in the Southern Hemisphere.

IN JUNE:

(a) The farther North a place is the (more/less) daylight it receives.

(b) The farther South a place is the (more/less) daylight it receives.

IN DECEMBER:

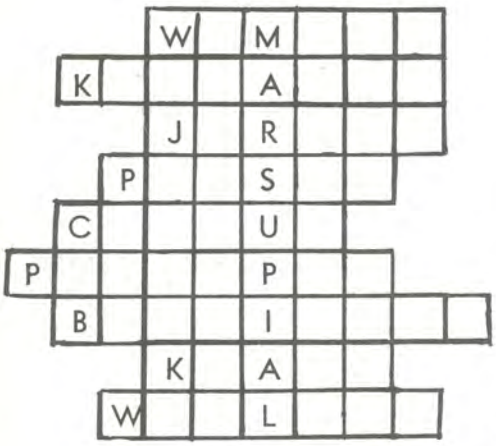
(a) The farther North a place is the (more/less) daylight it receives.

(b) The farther South a place is the (more/less) daylight it receives.

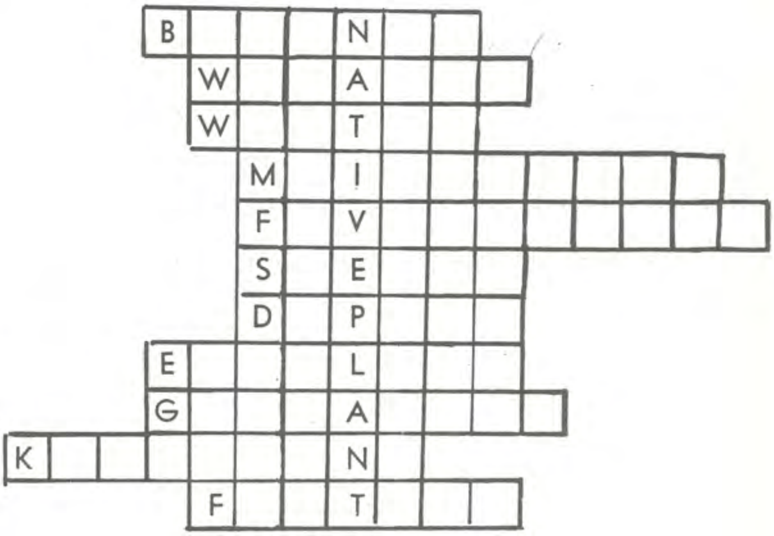
How much daylight has Murmansk? in June .... in December ....

How much daylight has Mawson? in June .... in December ....

DO YOU KNOW AUSTRALIAN WILD-LIFE?



One is not a Marsupial.
Which one?



HOW DO BABY ANIMALS KNOW?

Have you ever watched a baby chick getting out of an egg? How did it know what to do?

No-one told it. It just knew. We say that it did it by INSTINCT.

All baby animals know some things by instinct.

Baby mammals know how and where to get milk from their mothers.

Most baby animals seem to know what food is good to eat.

You never see a cabbage-caterpillar eating paper (though your baby brother might eat it).

Many baby animals must know everything by instinct.

Why? ....

Who teaches a baby spider to build a web? ....

Who teaches a baby snail how to make a shell? ....

Instincts are inherited from parents in the same way that shape and colour are. We think the baby animal does things in a certain way because its kind of animal has always done it that way.

Some animals use instincts when they are really no longer needed.
What does a dog do often before it lies down? ....

Why? ....

Lower animals do everything by instinct.

Higher animals have to LEARN how to do things. The higher the animal the more it has to learn.

Birds LEARN how to fly.

Young lions chase moving things by instinct, but they have to learn to hunt properly.

Dogs swim by instinct, but we must learn.

Name some things you LEARNT to do before you went to school.

If you have a pet, write down some things it does by INSTINCT and some it has LEARNT to do.

INSTINCT	LEARNT
....	....
....	....
....	....

GIVING PLANTS A CHANCE

At present practically all our food is made by plants so we must give plants every chance to make as much food as possible.

Most plants grow in soil, so we must look after the soil. The growing soil is the top soil.

In some places this is only just a few inches thick. This soil has taken hundreds of years to make and can be lost very quickly. The loss of soil is called EROSION.

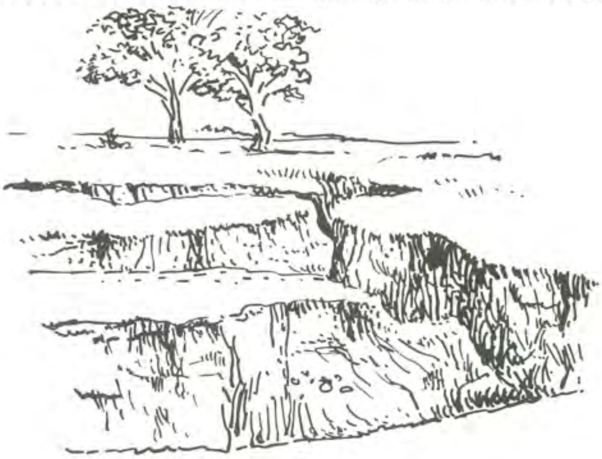
You may live in a place where there are "dust storms". Hundreds of tons of soil can be blown away. In some places it has all been blown away and the land is useless for farming.

Water carries away the top soil too. When it rushes down bare hillsides it makes huge gullies and carries soil to fill up dams and creeks and rivers.

This loss of soil can be reduced by good farming. Bare soil is lost more quickly than soil which has grass and trees on it, so good farmers do not cut down trees unnecessarily. They also keep a "cover" on their soil as much as they possibly can.

After they have taken off a crop they leave the stubble standing or plough it in to hold the soil. In earlier days they burnt the stubble. What effect would this have?

....



Gully made by Erosion

Soil removed by Erosion

Find a grassy place and a bare place in your playground. Look at the soil on each. Which place has the deepest top soil on it? ....

To stop water rushing down hills, good farmers plough around the slopes of hills instead of up and down. The furrows hold the water until it soaks into the ground. This is called CONTOUR ploughing. Some farmers make banks across the slopes of hills to prevent water running off.

CONTOUR BANKS

By planting better types of grasses and by using fertilisers farmers keep a better cover on their paddocks.

Some farmers tried to carry too many animals on their properties. In bad seasons the animals not only ate the ground bare, but sometimes ate the roots too. Rabbits ate the ground bare and helped erosion.

Miners often left the ground bare and liable to erosion. Sometimes chemicals from mines killed all plants. Beach miners now replace top soil when they have finished mining, and then plant grass and trees.

WATER

All plants need water and where there is not enough rainfall it can be supplied by IRRIGATION.

Find the names of some Irrigation Areas and where the water comes from.

IRRIGATION AREAS	SOURCE OF WATER

FERTILISERS

Plants need certain chemicals if they are to grow properly. Sometimes these are in the rocks from which the soil was made. Sometimes plants can obtain them from the remains of plants and animals.

Often we have to supply them by CHEMICAL FERTILISERS. This is especially so if we grow the same crop in the same soil year after year. It is almost impossible to grow wheat without adding superphosphate.

Name some chemical fertilisers.

....

....

Plants need very small quantities of certain chemicals for healthy growth. These are called TRACE ELEMENTS.

The addition of very small quantities of cobalt helped to turn semi-desert in South Australia into fertile pasture. Find out where this was. ....

The scientists who work for the C.......................... S........................ and I ....
R.......................... O.......................... and the F.............................. and A ....
O are constantly engaged in research to find ways of improving the quantity and quality of food.

You might try some research yourself.

EXPERIMENT.

Fill a number of small boxes or flower pots with sand or sub-soil (the soil deep down which does not contain any plant or animal remains). Leave one pot with soil only and add a different fertiliser to each of the others. You might try all, or some, of these:

Blood and bone, superphosphate, sulphate of ammonia, poultry or stable manure, a complete fertiliser from a packet.

Plant a few grains of wheat in each pot and keep the pots well watered.

Keep a record of any differences in size, colour, disease.

"KEEPING" FOODS

All foods become unfit to eat in time though some foods "keep" longer than others.

Name some foods that—

"Go bad" quickly ....

"Keep" well ....

Food deterioration (look up that word) is caused by:

(a) Chemical changes in the food—as when fruit goes "soft".

(b) Microbes or bacteria from the air or from people or other creatures touching the food.

(c) Spoiling by pests including rats, flies, weevils, cockroaches.

Food can be preserved by:

(a) Refrigeration. This slows down chemical changes and the growth of bacteria.

(b) Canning. Microbes are killed by heat and the sealed can stops others entering.

(c) Drying or dehydrating. Removing the water helps the foods to keep.

Milk is PASTEURISED. It is heated to kill bacteria and then is cooled quickly.

The word "Pasteurisation" is made from a man's name.

Who was he?

Why do we remember him?

How do we preserve these foods? There may be more than one way in each case.

Meat ....

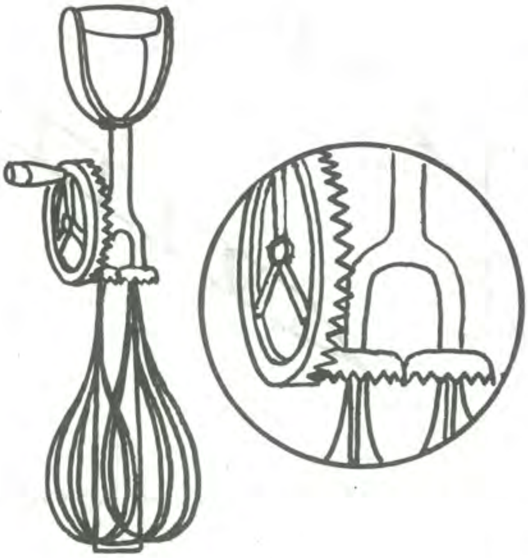
Milk ....

Fruit ....

Fish ....

Vegetables ....

WHEELS WHICH MOVE WHEELS



EXPERIMENT. Turn the handle of an egg-beater slowly and watch the beaters.

Do they turn the same way as the handle?

....

Do they both turn the same way? ....

Do they turn faster or slower than the handle?

....

Draw arrows to show which way each wheel turns.

The wheels have teeth or cogs which move other wheels. They are GEAR WHEELS.

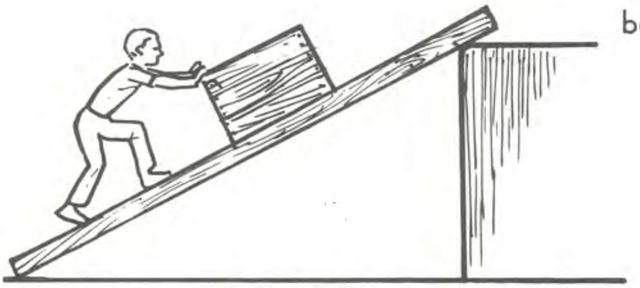
Gears (a) Change the direction of movement.

(b) Alter the speed of movement.

A large wheel moving slowly will make a small wheel move ....
See if you can find some gear wheels.

You might look at a bicycle, a sewing machine, a hand-drill, an old clock, an old type lawn-mower. If Dad ever strips the Gear Box down you may see them in your car.

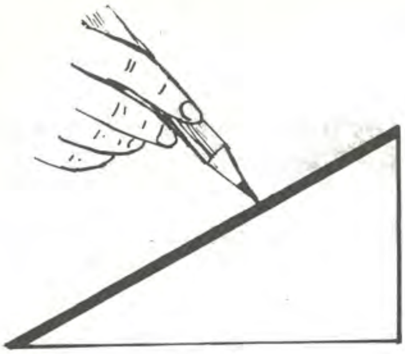
THE SCREW

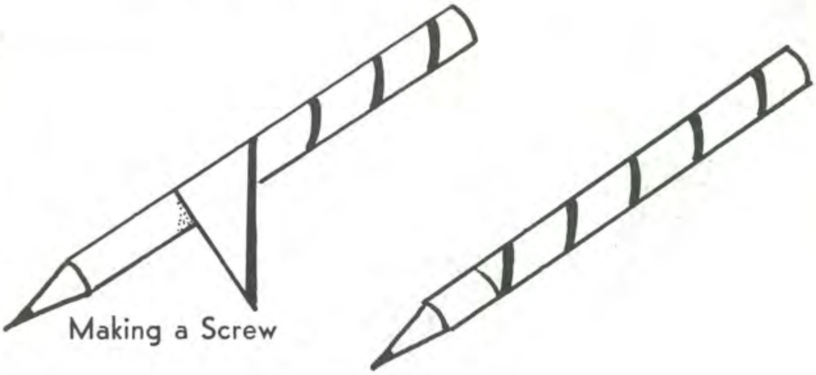


What is the boy using to help him lift the box? An I........................P..........................

Make an inclined plane by cutting a rectangle of paper 10 cm by 7 cm along one diagonal. Draw a black line along the sloping edge so that you can see it clearly. Wrap it around a pencil.

THE SCREW





Making a Screw

What does it look like?

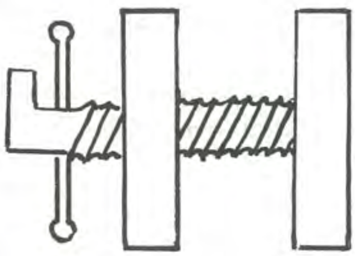
A SCREW is really an inclined plane, wrapped round a cylinder. Follow the path of the inclined plane by tracing it with your pencil point.

We use screws for joining things. Can you think why screws hold things more firmly than nails? ....

....

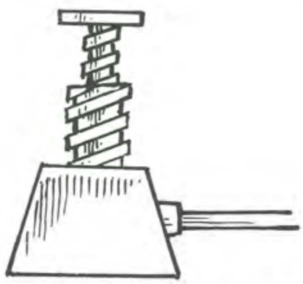
Some other uses of screws.

NUT AND BOLT



VICE

OFFICE CHAIR



A JACK is made of two screws

PESTS AND DISEASES

It is not enough for us to attempt to grow more and better food unless we make sure it is eaten by the people for whom it is intended.

Pests and diseases eat, spoil or destroy millions of tonnes of food every year. Complete **this table by filling in names from the list.**

Grasshoppers, aphis, caterpillars, rats, ticks, weevils, cockroaches, plant diseases, weeds, thrips, fruit flies, rabbits.

HARM DONE	PEST OR DISEASE
Eat growing crops.	....
Eat and spoil stored food.	....
Kill or weaken animals.	....
Kill or weaken plants.	....
Use soil and moisture needed by useful plants.	....
Carry plant diseases.	....
Carry animal diseases.	....
Eat food needed by domestic animals.	....

CONTROLLING PESTS.

Natural enemies. Many pests have natural enemies, which, if given the chance, will keep the pest under control.

Many birds eat ....

Cats eat ....

Eagle-hawks and Crows do some harm but Eagle-hawks eat rabbits and Crows eat insects and dead animals.

The Cactoblastis insect cleaned out Prickly Pear.

Toads eat cane-beetles.

Proper storage can prevent damage by rats and weevils.

Poisons. We control most pests by various kinds of poisons. We have poisons which will kill insects, rats, rabbits, ticks and weeds. Howeven, pests often become immune to a poison (it will no longer kill them), so stronger poisons have to be used.

Sometimes we can find a disease which attacks only a pest.

Myxomatosis killed only rabbits.

We control some plant and animal diseases by medicines.

Breeding. We breed plants and animals which are immune to the disease that was killing their species.

Quarantine. To prevent diseases like Rabies and Foot and Mouth disease entering Australia, animals brought into the country either have to have a Health Certificate or go into quarantine. This means that they are kept away from other animals until it can be seen whether they have a disease or not.

Some parts of Australia have diseases or pests not found in other parts. There are no fruit flies in Victoria so it is forbidden to take any fruit into Victoria in case it contains eggs or larvae. Most Queensland and Northern New South Wales cattle have ticks. To keep them out of the other parts of New South Wales there are tick gates and tick inspectors. The inspectors examine not only cattle but soil and plants which might carry tick eggs. The battle against pests has been going on at least since Old Testament times and it is likely to continue.

How do we control—

Rabbits ....

Ticks ....

Fruit fly ....

Rats ....

Lantana ....

Aphis ....

Weevils ....

Grasshoppers ....

EXPLORING ELECTRICITY

You have learnt about the kind of electricity we obtain by rubbing things. We call this STATIC ELECTRICITY.

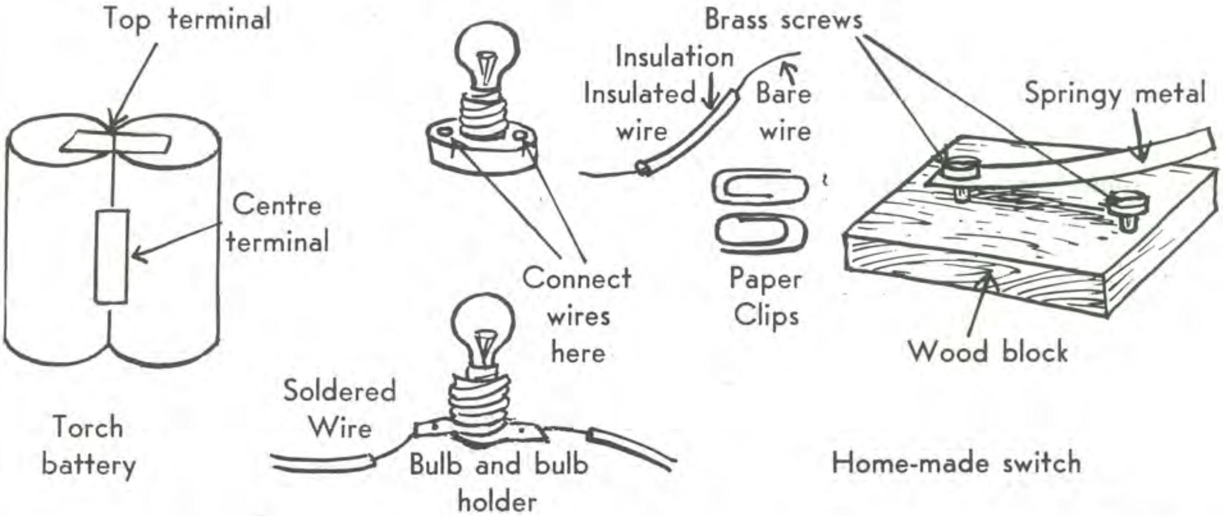
We cannot use this kind of electricity to light houses or run TV sets. For these purposes we use CURRENT ELECTRICITY. Both kinds of electricity consist of ELECTRONS. Find out about electrons in your library.

In STATIC ELECTRICITY they stay in the same place or move by jumps.

In CURRENT ELECTRICITY they flow along a wire rather like water flowing through a pipe. Electrons can flow through many solid things.

The flow of electrons is called an ELECTRIC CURRENT. In order to have an electric current we need a supply of electrons. We obtain them from a BATTERY or a DYNAMO.

We are going to find out about electric currents. For these experiments we will need— a cycle torch battery, a torch bulb, a bulb holder, 2 paper clips, a switch (you can make one like the drawing) and some thin insulated copper wire.



If your bulb holder does not have screws ask Dad to solder a short length of insulated wire on each lug.

When connecting wires, clean off the insulation at each end of the wire so that the ends are bare. Make your connections as tight as possible. The paper clips are useful for connecting wires to the battery terminals.

EXPERIMENT E1. Connect a length of wire from the centre terminal to one side of the bulb holder. Now connect another length of wire to the other side of the bulb holder.

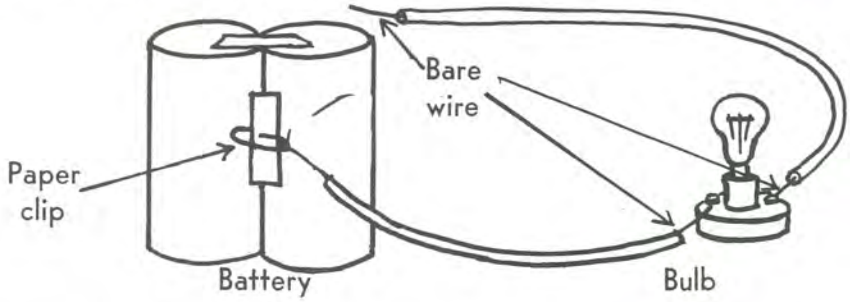
Screw in the bulb.

Does it light? ....

Now touch the free end of the wire to the top terminal of the battery.

What happens now? ....

What happens when you lift the wire off again?...



When you touched the top terminal of the battery you completed the CIRCUIT. For electrons to flow there must be a complete path from the battery back to the battery. If the path is broken they will not flow at all. When you lifted the wire you broke the circuit.

Often we want to be able to break the circuit when we like. To do this we use a switch.

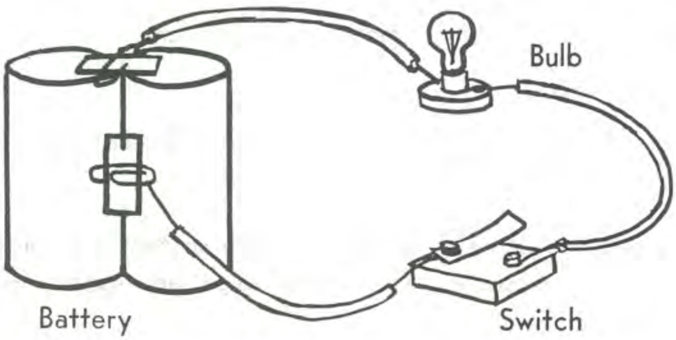
When the switch is closed, the current flows. When it is open the current ....

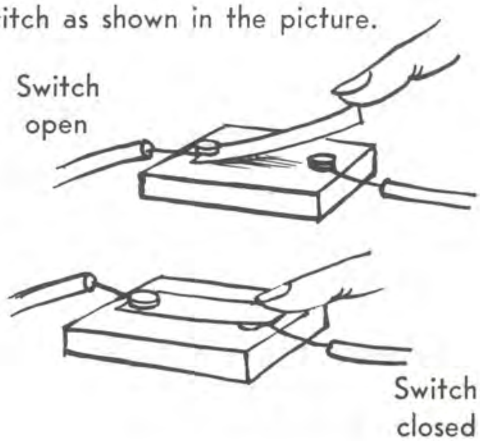
Name some things that have switches ....

....

....

EXPERIMENT E2. Connect the battery, bulb and switch as shown in the picture.





Close the switch. What happens?..

Open the switch. What happens? ....

When the switch is closed the current   and the bulb

When the switch is open the current .... and the bulb ....

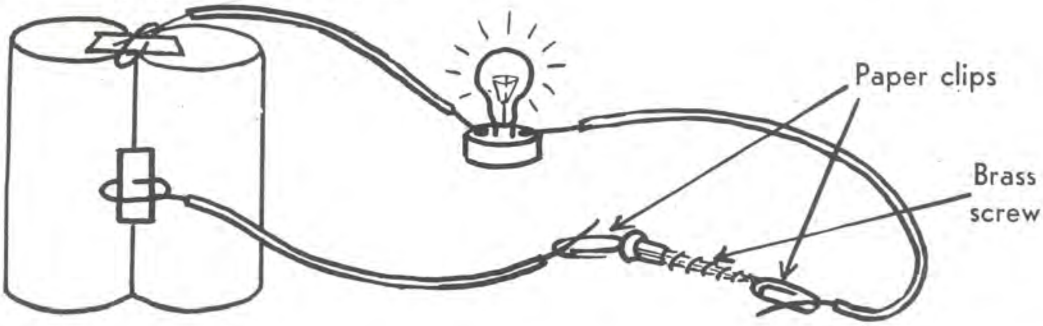
CONDUCTORS AND INSULATORS

Electrons do not flow easily through all substances.

Substances which allow electrons to flow easily through them are CONDUCTORS. Copper is a good conductor.

Substances which do not allow electrons to flow through them are NON-CONDUCTORS or INSULATORS.

EXPERIMENT E3. Connect the battery and bulb as shown in the drawing. Connect each of the wires to paper clips as shown.



Touch the paper clips together. The bulb should light up. Now touch the paper clips to each end of a brass screw.

Does the bulb light up?...

Brass is a (Conductor/Insulator).

Try the same experiment with the following articles. Write the articles in the lists of Conductors or Insulators below, when you have discovered where they belong.

Articles: A match, a nail, strip of plastic, strip of tinfoil, a rubber, piece of glass, darning needle, a pencil, a piece of pencil lead, plastic pen-holder, piece of wool, a five-cent coin, a piece of cotton.

CONDUCTORS ....

....

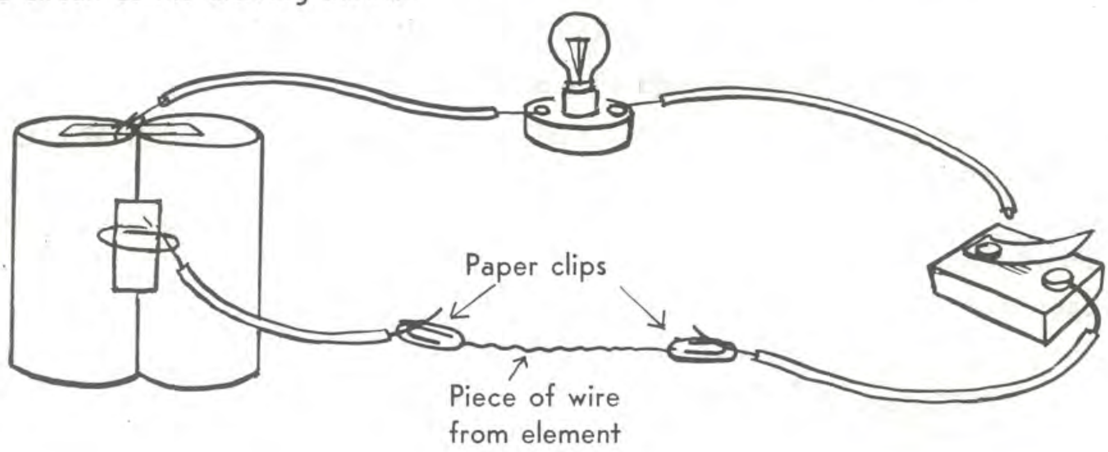
INSULATORS ....

....

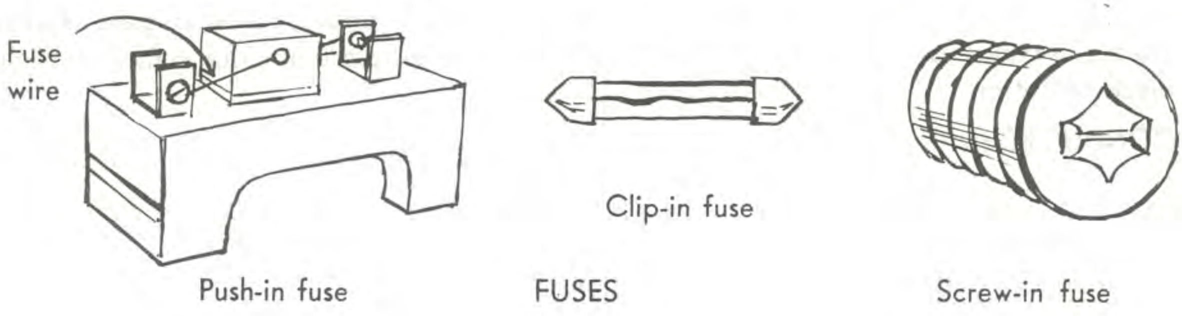
Now you see why it was necessary to remove the insulation before connecting the wires. Most metals are conductors. Copper and silver are good conductors.

ELECTRICITY AND HEAT

EXPERIMENT E4. Connect a piece of wire from an old radiator, toaster or iron-element in the circuit as the drawing shows.



Close the switch for a short while. Feel the element wire.
What do you notice?
This kind of wire is not a good conductor. As electrons struggle through it they make it hot.
This is how we use electrons for heating and lighting.
The filament in an electric light is a fine wire. The flow of electrons make it so hot that it glows.
If the current in a circuit becomes too great it may melt the wires and damage the machine.
To prevent this we use FUSES.
A fuse is made of wire that melts easily. If anything makes the current too strong the fuse wire melts first and prevents any damage. There is probably a FUSE-BOX in your house but DON'T TOUCH IT unless an adult is present.



FUSES

LEARNING MORE ABOUT ANIMALS

You have learnt that animals are divided into groups. The animals in each group are alike in some way.

This year you should try to find out more about the different animals in ONE group.

You can choose any group, but two very interesting groups are ARTHROPODS and MOLLUSCS. You might like to choose one of these groups.

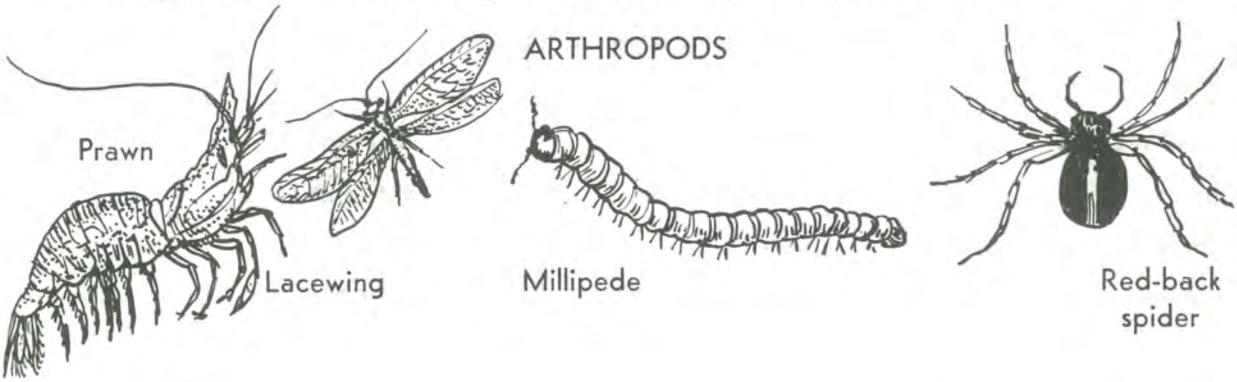
ARTHROPODS

There are more kinds of Arthropods than of all other kinds of animals added together.

Arthropods are found on land, in the air, in fresh water, in sea water, and in all climates.

1. They all have jointed legs. (Arthropod means "jointed foot").
2. They have external skeletons which are really hard skins.
3. They develop from eggs.
4. They often change very much from babyhood to adulthood. This is especially so with insects.

Because there are so many arthropods they are divided into smaller groups.



CRUSTACEANS	INSECTS	CENTIPEDES	SPIDERS
(crusty skins)	(all have six legs)	millipedes	scorpions
crabs	flies	centipedes	ticks
crayfish	butterflies		spiders
prawns	bees		
shrimps	beetles		
slaters	grasshoppers		

MOLLUSCS

This is a particularly good group to study if you live near the sea. Many molluscs have beautiful shells.

(a) They have soft slimy bodies.

(b) They often have shells. The shell may have ONE piece (UNIVALVE) or TWO pieces (BIVALVE)

(c) They live in water or in damp places.

(d) They usually move on a single foot.

(e) They develop from eggs.

Molluscs are divided into three smaller groups.

Cuttlefish

MOLLUSCS

Spider shell

Freshwater Mussel

UNIVALVES	BIVALVES	NO SHELLS
snails	mussels	octopuses
limpets	pipis	squids
cowries	oysters	cuttlefish

KEEPING RECORDS

There is a page for writing and a page for pictures.

You will have to put in your own headings as they will depend on the group you choose.

You could use these headings.

ARTHROPODS. Name, where found, colour, legs, wings, feelers, food, changes in growth, use or harm.

MOLLUSCS. Name, where found, shell, colour, food, use or harm.

You may not be able to fill in every column for every animal.

MY ANIMAL RECORD

Group ....

MY ANIMAL PICTURES

THE LAW PROTECTS OUR PLANTS AND ANIMALS

Of course, the best way to protect our plants and animals is for everyone to want to look after them. Unfortunately, everyone does not know their value and many people are thoughtless, cruel or greedy. So parliament makes laws for their protection and the breaking of these laws can bring heavy fines or even terms of imprisonment.

The Chief Secretary's department has the job of seeing the laws are obeyed and if you want to know how our fauna (animals) and flora (plants) are protected you should get in touch with:

The Fauna Protection Panel,

Chief Secretary's Department,

9th Floor, Caltex House,

167 Kent Street, Sydney.

Certain areas have been declared as Faunal Districts. These are sometimes called Sanctuaries but the word Sanctuary has so many meanings that the description Faunal District is preferred.

In COMPLETE FAUNAL DISTRICTS no bird or mammal may be taken without a licence. It is illegal to carry a gun or any other means of harming wildlife.

In ORDINARY FAUNAL DISTRICTS only SCHEDULED (listed) birds and mammals may be taken without a licence.

However there is no law that prevents the cutting of trees or altering the habitat (living conditions) in a faunal district so the Fauna Protection Panel is now proclaiming some areas as WILDLIFE REFUGES.

These are Complete Faunal Districts where the natural environment will be retained. These refuges may be in National Parks, Water Conservation Areas or on Private Land if the owner is willing.

FAUNAL RESERVES are areas of CROWN LAND for the preservation and care of fauna. They cannot be established on private land. They are controlled by the Fauna Protection Panel.

The land within one mile of any school is an Ordinary Faunal District [Sanctuary].

PROTECTED FAUNA AND FLORA must not be harmed in any way, in any place or at any time except during an OPEN SEASON or with a LICENCE approved by the Chief Secretary.

All native mammals except dingoes, flying foxes and wombats are protected. Most native birds are protected.

Most native plants growing wild are protected. Included are Boronias, Christmas Bells, Waratahs, and most Orchids and Ferns. You can get lists of protected fauna and flora.

Some animals are proclaimed RARE FAUNA and there are very heavy penalties for harming them.

SCHEDULED FAUNA are not protected, except in complete faunal districts. They are pests and many of them are not native. They include dingoes, flying foxes, ferrets, hares, rabbits, crows, starlings and sparrows.

OPEN SEASON. The Chief Secretary may allow certain protected animals to be killed in certain areas at certain times if they are becoming too numerous.

LICENCES may be granted for killing protected animals when necessary. Shooters have licences to kill kangaroos in Western New South Wales.

ROYALTIES are payments given to encourage the killing of pest animals. There is a royalty for Dingo scalps.

RANGERS are people who see that the protection laws are kept. Policemen, public school teachers, among others, are rangers. Other people can become Honorary Rangers by applying to the Chief Secretary's Department, Box 30, G.P.O., Sydney.

Perhaps one day we shall not need all these laws to protect our wonderful heritage of wildlife, but this day will only come when we all learn to appreciate their worth, fascination and beauty.

In the meantime do all YOU can to see that they survive.

Are YOU a member of The Gould League? Are YOU careful when you go Bushwalking that you leave no harm behind you?

Do YOU believe with Ellis Troughton . . .

"That, because the Australian continent fostered all the fascinating furred animals, birds and flowers that awaited the coming of civilisation, our land must remain their everlasting sanctuary."

MAKING SOUNDS AND HEARING SOUNDS

Sounds are made by VIBRATIONS.
What vibrates to make the sound in these musical instruments.

(a) a violin	(f) cymbals ....
(b) a drum	(g) a xylophone ....
(c) a mouth organ	(h) a pipe organ ....
(d) a recorder	(i) a piano ....
(e) a guitar	(j) a trumpet ....

Sound waves always travel through something; air, water, metal and so on.

If the moon blew up would we hear the explosion? ....

Give a reason for your answer. ....

Sounds travel best through solids, next best through liquids, worst through gases.

Why can you hear the sound of something approaching better by putting your ear to the ground? ....

Generally short instruments make high-pitched sounds. Long instruments make low-pitched sounds.

By altering the length of the vibrating thing we can change the pitch of the sound.

THE SOUND-MAKER IN OUR THROATS

We use our vocal cords to sing or speak. There are two of them in a box called the VOICE-BOX or LARYNX. It is the hard lump that moves when you swallow.

When you speak or sing you force air from your lungs past the cords and make them vibrate.

You tighten the cords for high notes and loosen them for low notes.

YOUR VOICE BOX

Put your finger on your larynx. Make a low note and then a high one. Can you feel your larynx move? ....

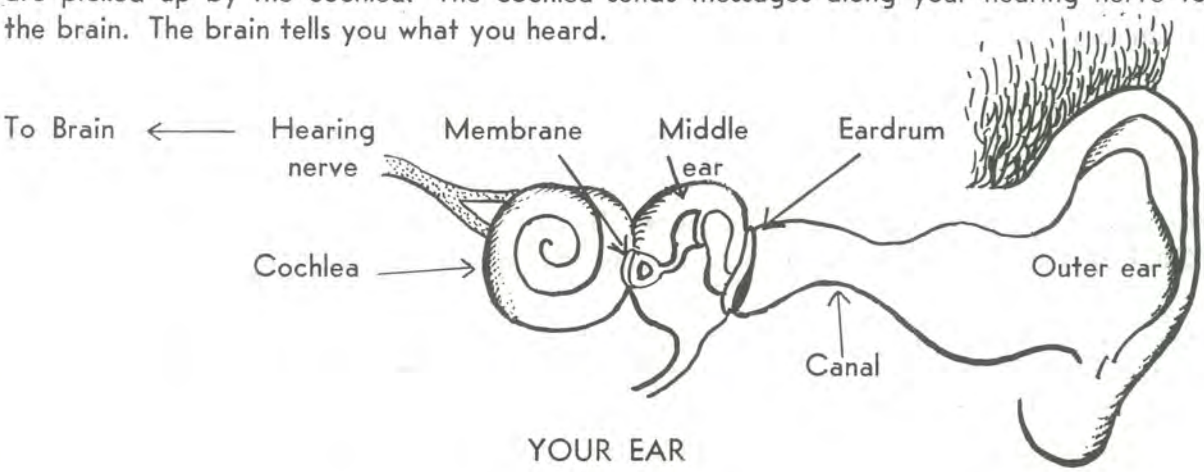
The nose, tongue, lips and mouth alter the sounds to make speech.

When you shout or speak loudly your cords vibrate very quickly. If you shout too much they become sore and you have "a sore throat" or your voice becomes hoarse. Trying to sing very high or very low notes can make them sore too. Look after your vocal cords. They have to last you all your life.

HOW WE HEAR SOUNDS

Most sounds reach your ears through the air.

The vibrating air makes your ear drum vibrate. This makes some small bones in your middle ear vibrate. These bones make a membrane in your inner ear vibrate. The vibrations are picked up by the cochlea. The cochlea sends messages along your hearing nerve to the brain. The brain tells you what you heard.



YOUR EAR

PUTTING PLANTS AND ANIMALS IN GROUPS

Have you a FELIX DOMESTICUS in your house?

Perhaps you did not recognise your cat under its scientific name. Probably you think it is silly to give it a long name like that. The scientist does not think so. To him it is very important that every plant and animal should have one special name.

Often birds and animals have different names in different places.

How many names can you find for the PEE-WEE? ....

....

Sometimes a name means a different creature in different places.

A Hawk is a different bird in different countries and in different parts of Australia.

The first part of the name tells the scientist what group the animal belongs to.

Felis means the Cat group.

What are these big cats?

Felis leo .... Felis tigris .... Felis pardus ....

The man who first worked out a system of naming creatures was CARL VON LINNE or in the Latin form Carl Linnaeus.

He was a famous botanist and he spent many years classifying and naming plants.

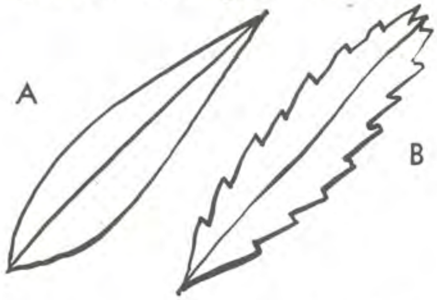
There are usually two words in each name. The first is the group name and the second is a special name which often describes some special feature of the animal or plant.

Two kinds of banksias are—

Red Honeysuckle: Banksia serrata.

White Honeysuckle: Banksia integrifolia.

Find out the meaning of "Serrated". ....



Which of these plants is which?

A. Banksia ....

B. Banksia ....

Where did the name Banksia come from?

....

All wattles are Acacias. Sydney Golden Wattle is Acacia longifolia. Find out what longifolia means. ....

THE ENERGY OF MOVING AIR AND WATER

Moving air and water have great stores of energy. Often this energy damages and destroys.

Hurricanes destroy buildings, tear down trees and change whole landscapes.

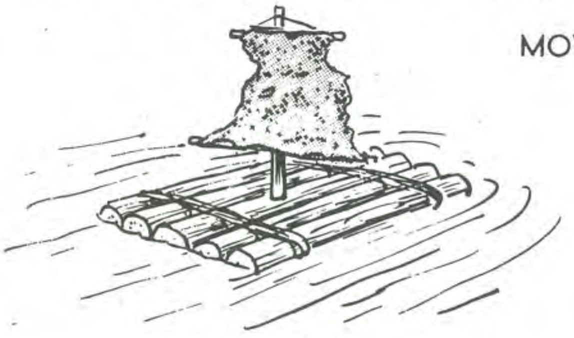
Flooding rivers move hundreds of tons of earth and wash away houses.

The sea makes or washes away beaches overnight. It moves huge boulders and carves masses off the coastline.

Man has learnt how to use some of this energy though it took him thousands of years to learn.

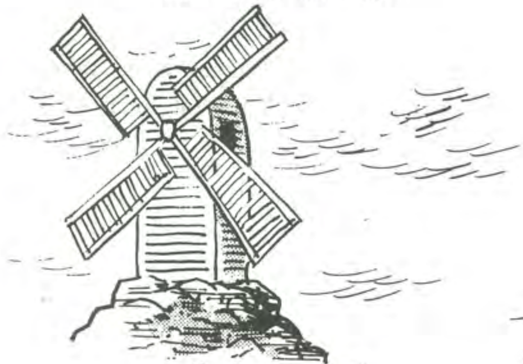
Here are some of the ways man uses the energy of moving air and water.

MOVING AIR



Raft with skin sail

Racing yacht



Early windmill

Modern windmill

What were windmills first used for? ....

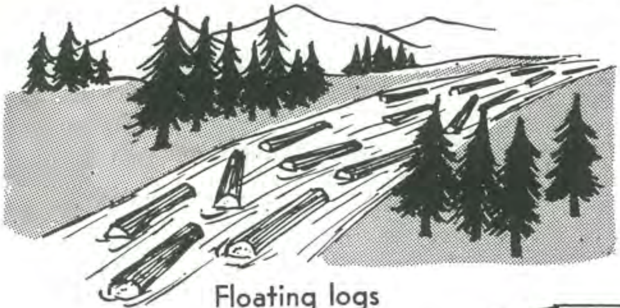
What European country has many windmills? ....

What are they used for? ....

Name two uses of windmills in Australia. ....

....

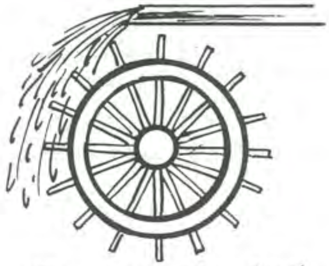
MOVING WATER



Floating logs

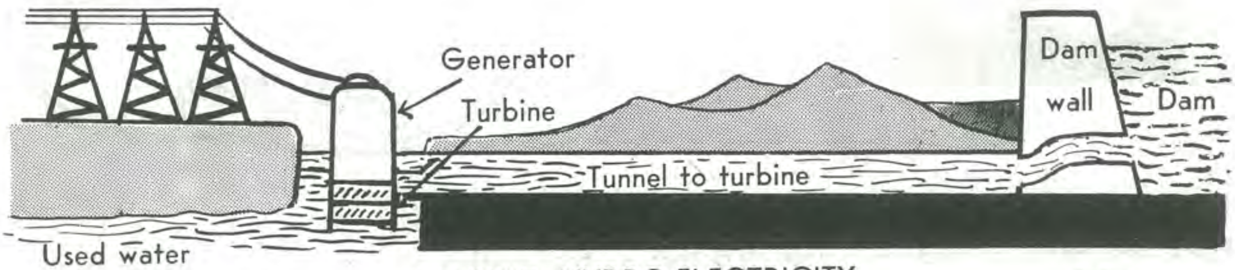
Water mill

Undershot waterwheel



Overshot waterwheel

Turbine

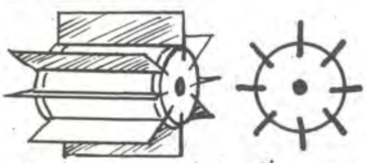


MAKING HYDRO-ELECTRICITY

Make a Water Wheel

End view

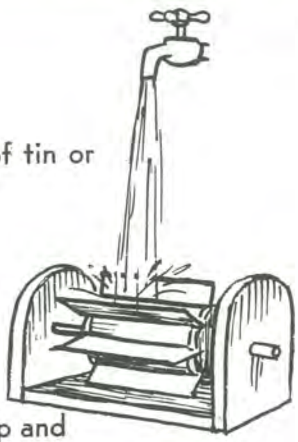
1. Make 8 saw-cuts in a cotton reel.



2. Cut 8 vanes out of tin or sheet metal.

3. Push the vanes into the saw cut.

4. Use a pencil as an axle.



5. Put it under the tap and watch it spin.

ELECTRICITY AND MAGNETISM

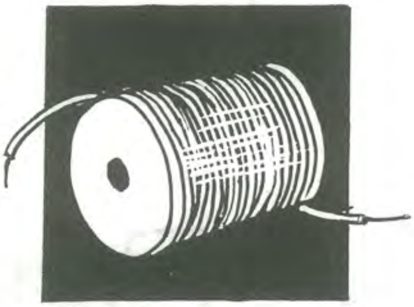
Electricity and magnetism are close relatives.

You may remember that a compass needle is a .... and when we brought another magnet near it the needle ....

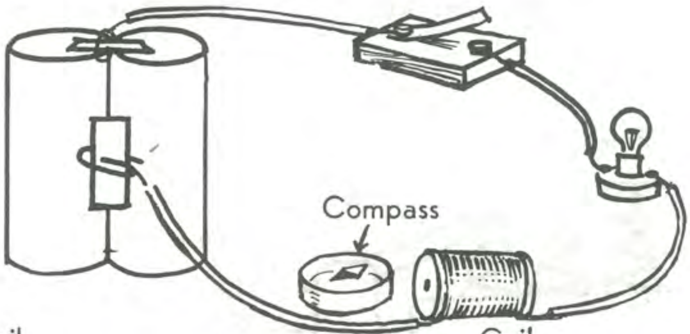
We can use a compass to test for magnetism.

EXPERIMENT E5. You need 3 metres of insulated wire, a cotton reel, some cellotape, and a small compass. You will use your bulb, and bulb-holder, torch battery and switch.

Leave 30 cm of the wire and wind the rest neatly around the cotton reel, leaving about 30 cm at the other end. Fasten in place with cellotape. Connect the coil as drawing shows.



A Magnetic Coil



Place the compass and coil close together so that neither end of the compass points to the coil. The compass needle will always point North and South so you will have to move the coil. The bulb is only there so you can be sure that the current is flowing. Close the switch. What happens to the compass needle? ....

....

Open the switch. What happens now? ....

Why? ....

Close the switch and note which end of the needle points to the coil.

Place the compass at the other end of the coil and close the switch. Which end points to the coil now? ....

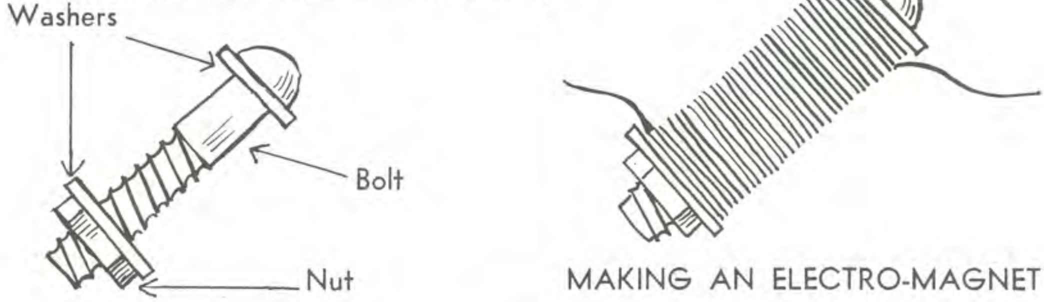
Show which way the needle moves in each case. Label the N and S poles of the coil.

While the current is flowing the coil is a magnet with a North Pole and a South Pole.
EXPERIMENT E6. You need an iron nut and bolt, two washers, 2 metres of insulated wire some cellotape.

1. Place a washer at each end of the bolt and screw the nut on until the end of the bolt just comes through.

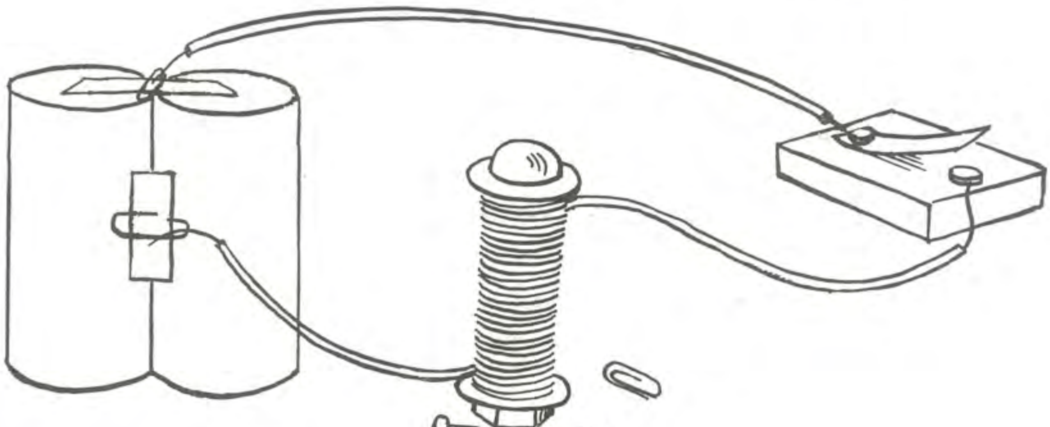
2. Leave 30 cm of wire and then wind the rest neatly on the bolt, leaving about 30 cm of wire at the other end.

3. Fasten the wire in place with cellotape.



MAKING AN ELECTRO-MAGNET

Connect the coil as shown in the diagram.



Close the switch and bring the coil near a paper clip, a tack, or a steel pin.

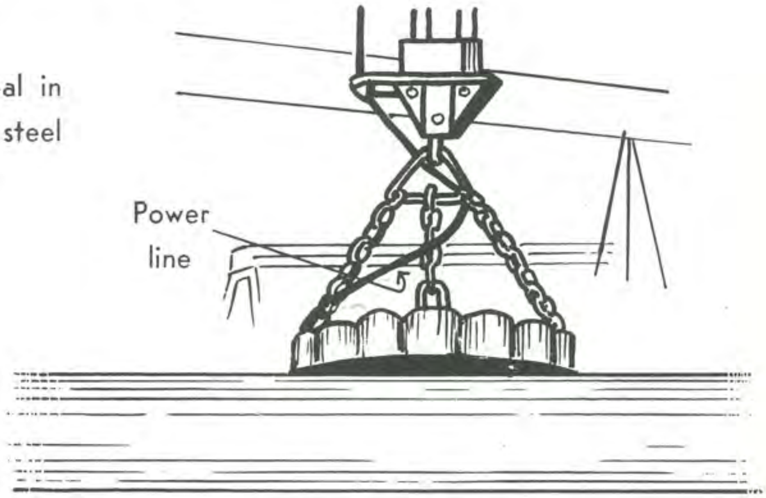
What do you notice? ....

The bolt has become a magnet. We call it an ELECTRO-MAGNET.

Open the switch. What happens now?...

The bolt is only a magnet while the current is

Electro-magnets are used a great deal in industry. You may have seen one at a steel works.



Electro-magnet

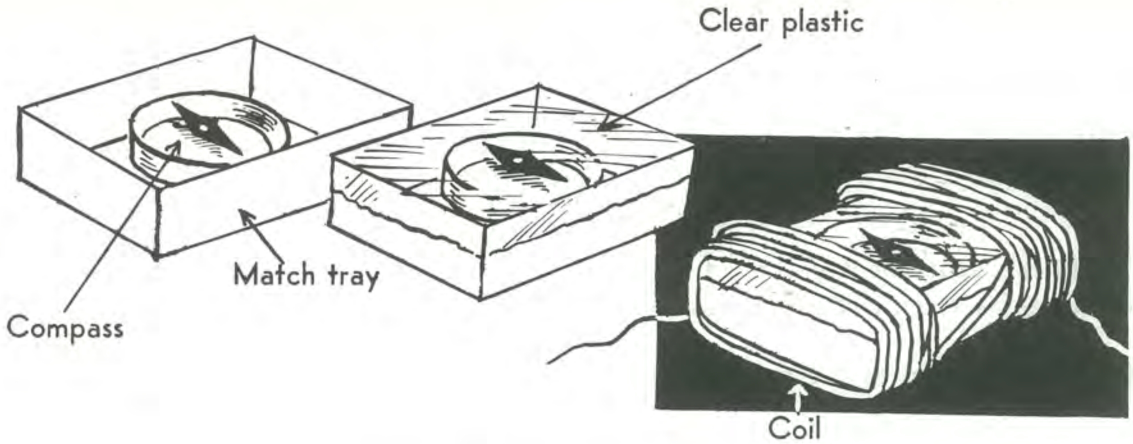
Because a current of electricity makes magnetism, we can make an instrument which detects electric currents.

EXPERIMENT E7. You need a small compass, a match-box tray, 3 metres of insulated wire, a small piece of clear plastic, some cellotape.

1. Place the compass in the match-box tray and fasten it with cellotape.

2. Cover the top of the tray with clear plastic kept in place with cellotape.

3. Leave 30 cm of wire and then wind the rest around the match-box tray. Leave a space so that you can see the compass needle. Leave about 30 cm of wire at the other end. Fasten in place with cellotape.

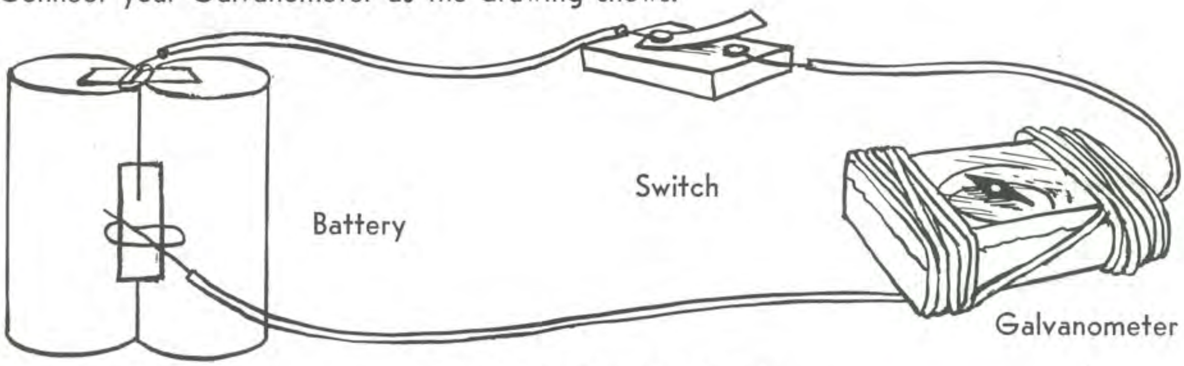


MAKING A GALVANOMETER

This instrument is called a GALVANOMETER.

All electricity-measuring instruments are similar to this. When you use it make sure that the needle is parallel to the coils before you start.

Connect your Galvanometer as the drawing shows.

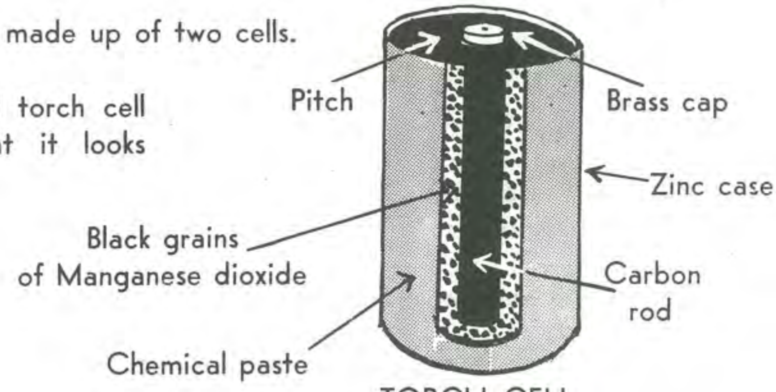


MAKING ELECTRICITY

We said earlier that to obtain electrons for current electricity we used a .... or a ....

You have been using a battery made up of two cells.

EXPERIMENT E8. Take an old torch cell to pieces. You will find that it looks something like this.



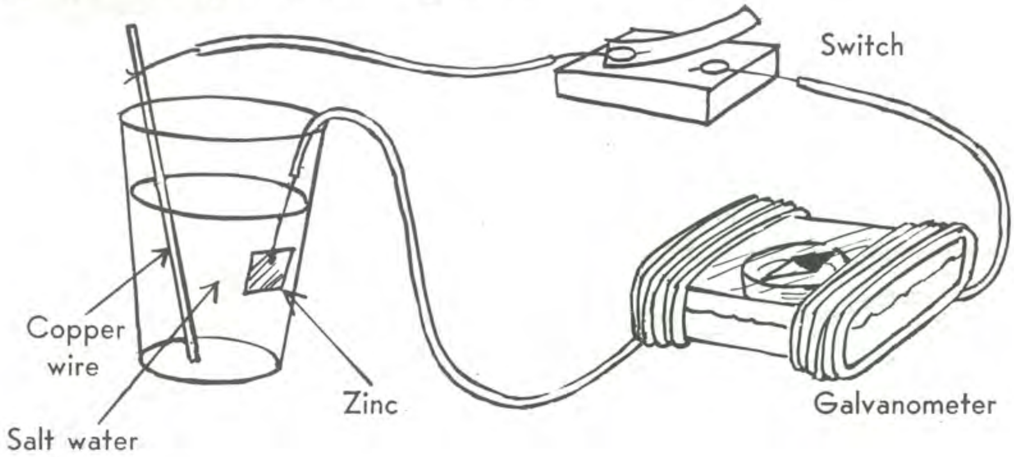
TORCH CELL

All electric cells have two different conductors and a liquid chemical. In a torch battery the liquid is mixed with something to make a paste, so that it will not run. The black grains of manganese dioxide make the cell work better. Other substances can be used to make a cell.

MAKING A CELL

To do this experiment you need a piece of thick copper wire, a piece of zinc from the outside of a torch cell and a glass of salt water.

Connect them up as the drawing shows.



Make sure all the connecting wires are clean and the connections tight.

Watch the compass needle as you close the switch.

What happens? ....

Why? ....

The current stops quickly. Later you will learn why.

Try the same experiment with a carbon rod and a piece of zinc in dilute vinegar.

Now try it with a piece of copper wire and a piece of zinc in lemon juice or very weak sulphuric (car battery) acid. Be careful if you use sulphuric acid. It is dangerous.

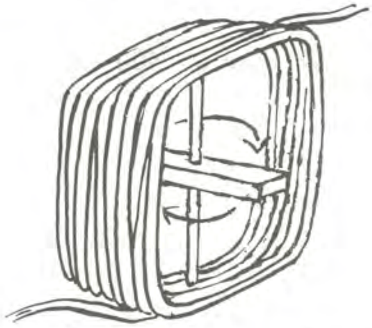
The currents are very weak and you will have to watch the needle closely.

A cell does not really make electricity. It sets free the electrons in the substances. It changes Chemical Energy into ELECTRICAL ENERGY.

DYNAMOS or GENERATORS

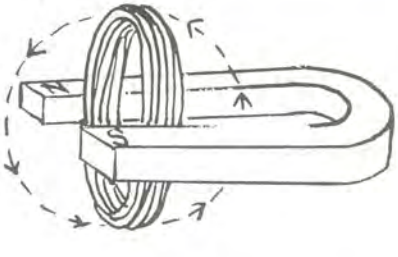
You may remember that we used electricity to make magnetism. We can use magnetism to make electricity.

If we spin a magnet inside a coil of wire, or spin a coil of wire between the poles of a magnet we generate a current of electricity in the coil. This is the way a generator or a dynamo makes electricity. Generator and dynamo mean the same thing.

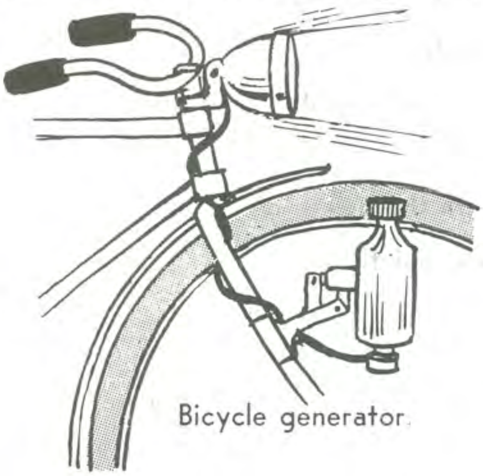


Spinning magnet in coil

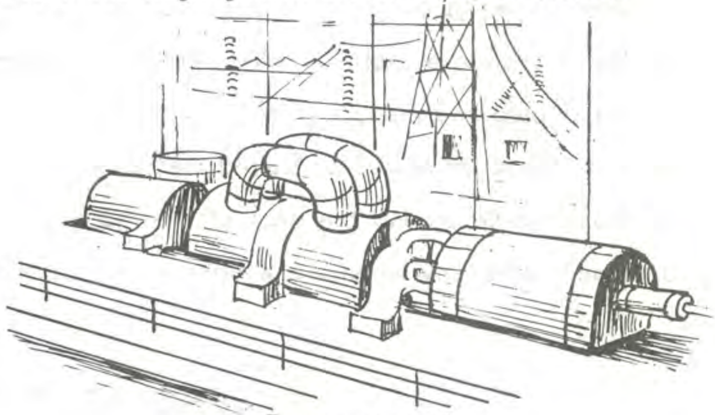
Spinning coil in magnet



You may have a generator on your bicycle or if you live in the country you may have your house generator or you may have seen the huge generators at a power station.



Bicycle generator



Power generator

Generators must be "driven" by something.

This means they must be given ENERGY. This energy may come from steam, from falling water, from wind. You may be able to think of other ways.

Generators change this energy into ELECTRICAL ENERGY.
Generators and cells are both energy changers.

When the generator of your bicycle lights the lamp, what energy is changed into electrical energy?

BE CAREFUL WITH ELECTRICITY

Electricity can be very dangerous.

We measure the pressure of electricity in VOLTS.

You have been using low pressures, which are safe. A torch battery is about 3 volts. Your car battery is 6 or 12 volts. 12 volts can give you a shock.

The house mains are 240 volts and this can KILL you. The stove may be 400 volts.

Main power lines can be up to 300,000 volts.

Treat electricity with care.

SOME ELECTRICITY SAFETY RULES

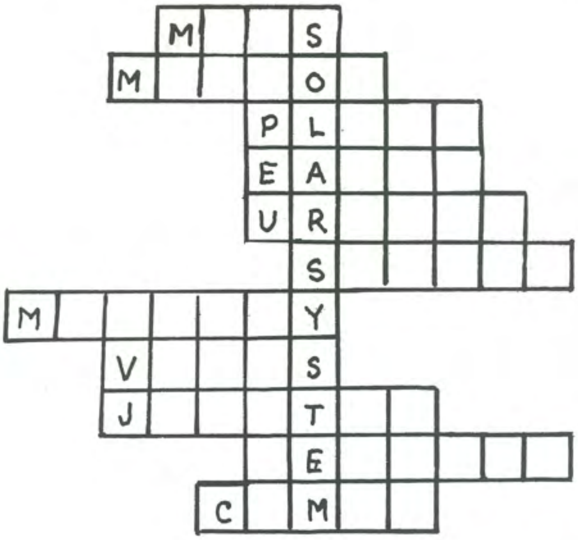
1. Don't touch a switch or any electrical equipment with wet hands.
2. Don't change a globe or plug without switching it off.
3. Don't plug too many electrical appliances into one power point.
4. Don't have damaged or frayed electrical cords.
5. Don't fiddle around the back of the radio or TV with the power on.
6. Don't poke anything into a light socket or a power point.

TREATING ELECTRIC SHOCK

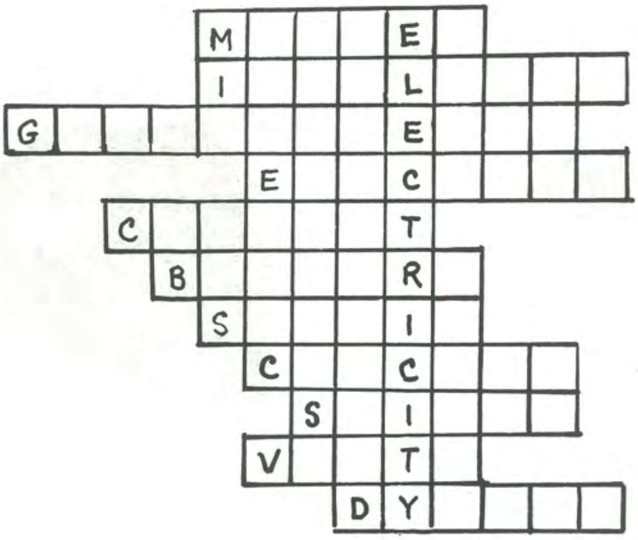
1. Don't touch anyone who has been shocked until you are sure it is safe.
2. Call an adult if possible.
3. Switch the power off if possible.
4. If you can't switch the power off, push or pull the wires away with a DRY stick or a DRY rope. BE CAREFUL.
5. Call a doctor.
6. Give artificial respiration. You should learn how to do it.
7. Keep the victim warm.

DO YOU KNOW?

The Solar System?



The Electrical Terms?



ROCKS OF THE CRUST

Do you remember the three kinds of rocks?

I............................, made by the cooling of molten rocks from the Mantle.

S................................, made from tiny pieces of eroded rocks. These had settled down in an area, usually under the sea and been pressed together again.

M...................................., made when the other two kinds had been changed by heat or pressure.

Place these rocks in their proper column.

Granite, shale, marble, basalt, slate, limestone, pumice, sandstone, conglomerate, clay.

IGNEOUS	SEDIMENTARY	METAMORPHIC

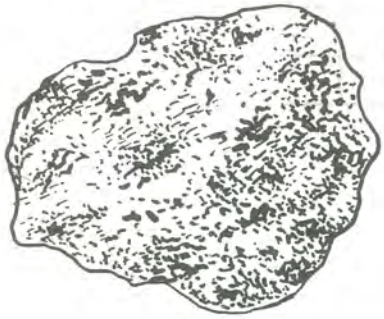
Some igneous rocks cooled slowly under the surface. These rocks have large crystals.

Others cooled quickly on the surface. They have small crystals and look glassy.

Look at a piece of granite and a piece of basalt.

Which cooled below the surface?............................

Which cooled on the surface?....................................



Granite

Basalt

I hope you have made a collection of rocks and named them. Keep them in separate groups.

Look at the igneous rocks in your collection. Try to decide if they cooled on or below the surface.

HOW OLD ARE ROCKS?

Geologists think that the first rocks were made about four thousand million years ago. The first rocks have all disappeared.

What happened to them? ....

....

You may wonder how they know the age of rocks.

One way is by studying the fossils in the rocks. However, the older rocks have no fossils.

Why not? ....

If there is the metal Uranium in rock the geologist can calculate its age very accurately.

Uranium slowly but regularly changes to lead. By finding the amounts of lead and uranium in a rock the geologist can calculate its age. In this way we have found out that the oldest known rocks are in Greenland. They are over two thousand million years old.

WEALTH FROM THE CRUST

You have learnt that we obtain metals from the crust. Name some metals. ....

....

Generally we call substances obtained from the earth's crust MINERALS. Minerals include rocks and metals.

What is the most important mineral made from plant remains? ....

Here are some other things we obtain from the crust. Write after each what it is used for.

granite .... clay ....

basalt .... limestone ....

diamonds .... sand ....

sandstone .... gravel ....

marble .... shale ....

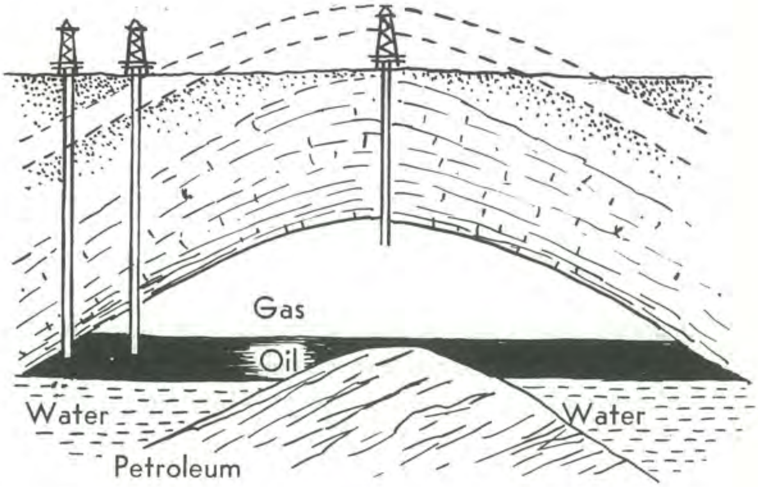
PETROLEUM

Another very valuable substance found in the crust is PETROLEUM (OIL). Many scientists think petroleum was formed from the remains of tiny sea-creatures called plankton.

Others think it was formed when the earth cooled. Perhaps it was formed in different ways in different parts of the world.

Petroleum is always found in sedimentary rocks.

Plankton



Petroleum

To obtain the petroleum a hole is drilled deep into the earth. Gas pressure forces the oil up to the surface. Petroleum is a thick black sticky liquid which is often mixed with water and sand or mud.

At a refinery the crude oil is split up into many substances, including petrol, kerosene, diesel oil, lubricating oils, vaseline, grease and asphalt.

Where are there oil refineries in Australia? ....

....

SOIL

Soils are made from broken down rocks.

Basalt makes a rich, reddish brown soil. Granite and shale soils are clayey and heavy. Sandstone makes light, sandy soils.

What rocks are found in your district? ....

What kind of soil is found in your district? ....

Was it made from the rocks in your district? ....

If not, how did it get there? ....

MAKING LIGHT BEND

Light travels in (straight curved) lines.

Light can be .... from shiny surfaces.

Light can be made to bend.

EXPERIMENT RL1. Place a pencil in a glass jar of water. Look at it from the top.

What does the pencil seem to do? ....

Look at it from the side.

What does the pencil seem to do as it enters the water? ....

....

Draw the pencil in the water.

Of course the pencil is not bent or broken.

It seems to be so because the light bends as it goes from water to air.

This bending is called REFRACTION.

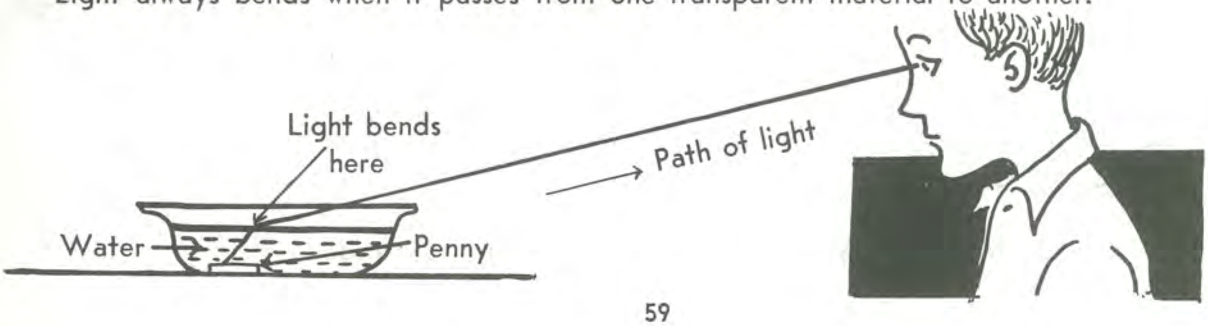
Light travels faster through air than through water and this makes it bend.

EXPERIMENT RL2. Place a 20 cent piece in a pottery dish. Move back until you just cannot see the coin. Now ask a friend to pour water slowly into the dish.

What happens? ....

You can see the penny because the light from it bends as it leaves the water.

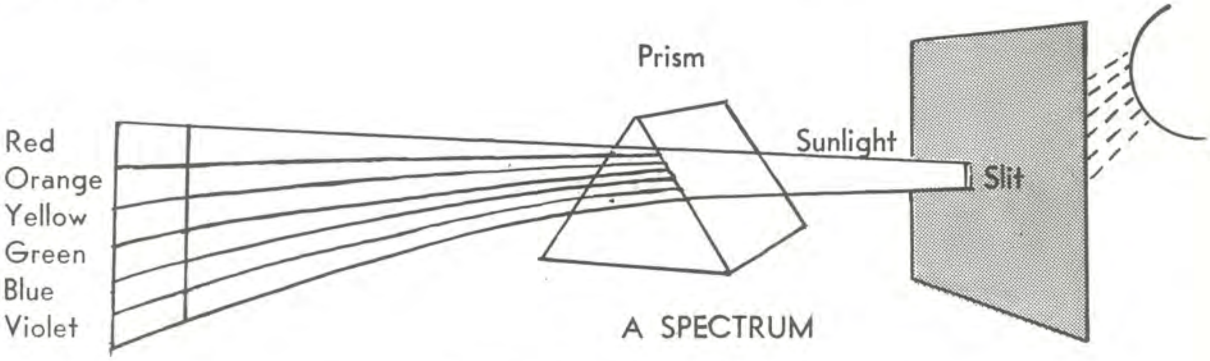
Light always bends when it passes from one transparent material to another.



EXPERIMENT RL3.

You need a piece of glass shaped like the one in the picture. It is a glass prism. A triangular piece from an old chandelier will do.

Hold the prism in a ray of sunlight until you get a band of rainbow colours. If you do the experiment in a darkened room and only let light in through a small hole the effect is much better.



A SPECTRUM

Colour the picture.

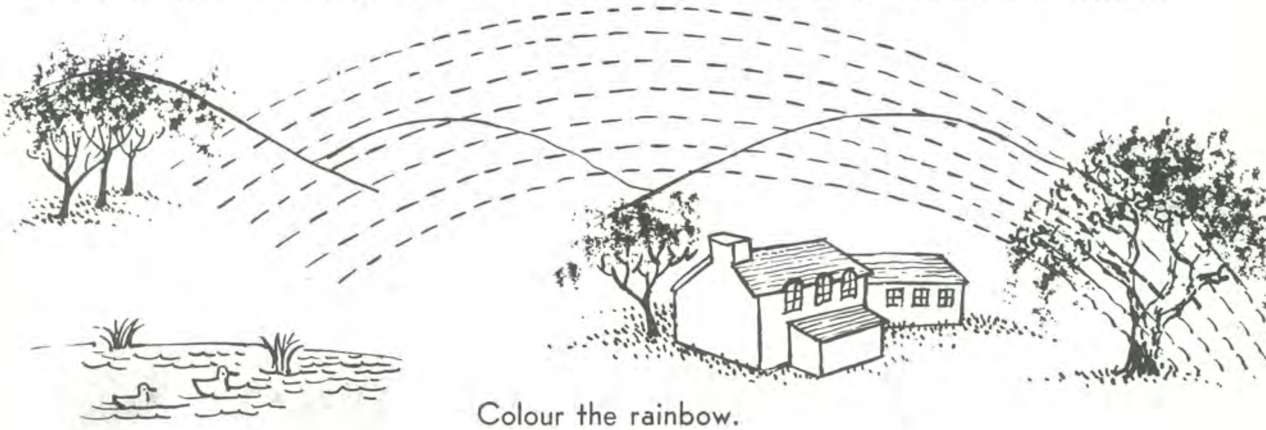
Sunlight is made up of different coloured lights.

All these do not bend the same amount. Red bends least and violet bends most. So the light spreads out in a strip called a SPECTRUM.

Where have you seen these colours before? ....

Of course. In a rainbow.

If the sun and a rain cloud are in the right place the raindrops act like little prisms.



Colour the rainbow.

Make sure you have the colours in the right order.

THE SPEED OF SOUND

Sound travels at about 1200 km per hour in air. This is about 330 metres per second or 1.6 km in five seconds. This is quite fast but very slow compared with light, which travels at 300 000 km per second.

We think of light taking no time at all to travel short distances.

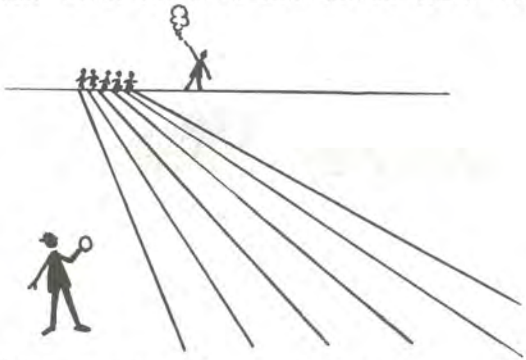
Explain why You can see the coin because the light from it bends as it leaves the water.

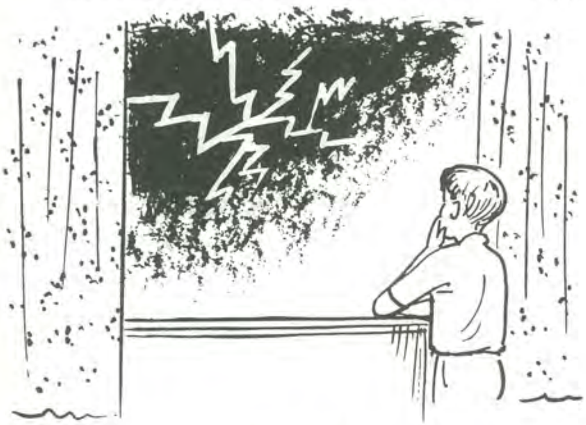
(a) A time-keeper for a race starts his stop-watch when he sees the smoke from the starting gun and not when he hears the bang. ....

....

....

....





(b) There are several seconds between seeing a lightning flash and hearing the thunder.

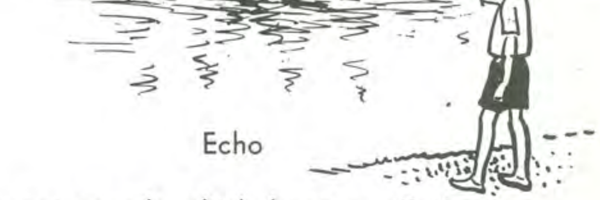
....

....

....

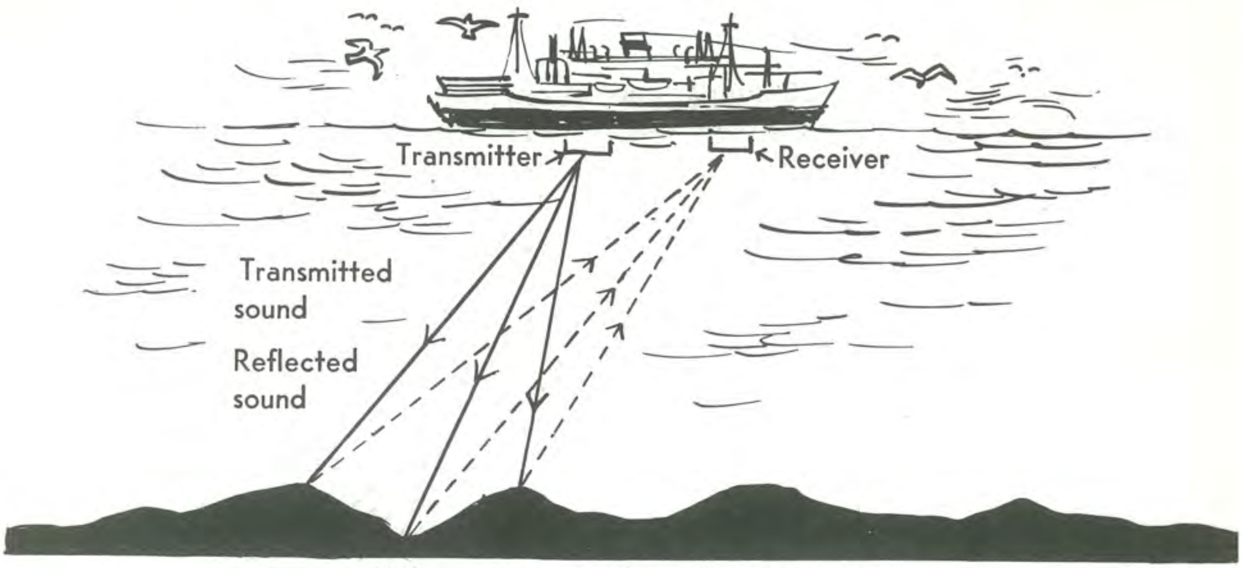
ECHOES

Sound bounces off solid objects. The reflected sound is an ECHO. We can use echoes to measure distances and to find objects.



Echo

Scientists learn about the ocean floor by sending out sounds which bounce off the sea bed. The echoes are recorded by special instruments and the different times taken for the echo to be heard give a picture of the ocean floor.

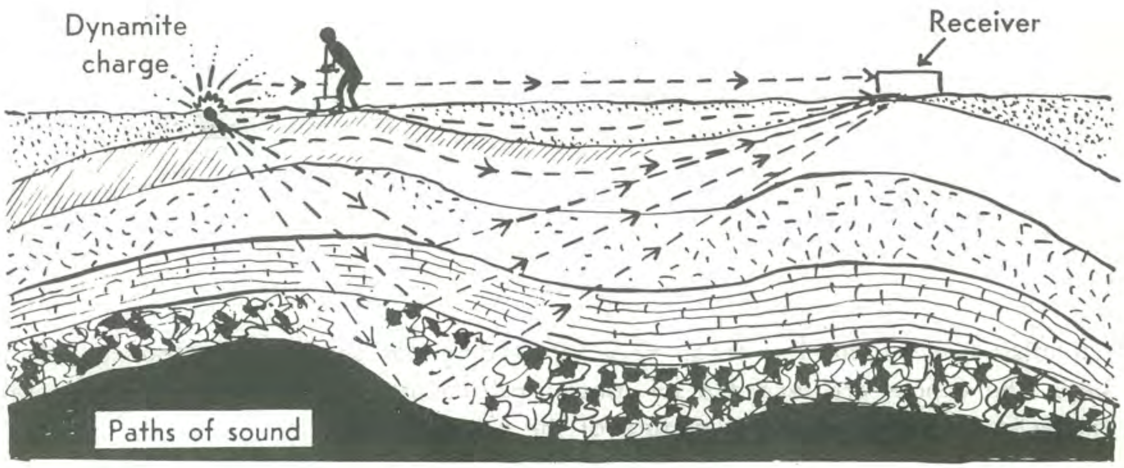


Using echoes to chart the ocean floor.

Fishermen use similar apparatus to find shoals of fish.

Submarines are tracked by echo-sounding equipment.

Oil seekers dig a small hole and set off a charge of dynamite. The sound travels through different rock layers and is picked up by instruments a kilometre away. Because soun travels at different speeds through different materials they can discover what sort of rocks are there. It is believed that bats and porpoises use echo-sounding to find their way in the dark.



ENERGY FROM COMPRESSED AIR

EXPERIMENT A3. Place your finger over the outlet of a bicycle pump and push the handle in slowly.

Does the pushing become easier or harder? ....

It becomes harder because you keep pushing air into a smaller space. You are COMPRESSING it.

EXPERIMENT A4. Push the handle in and then let go.

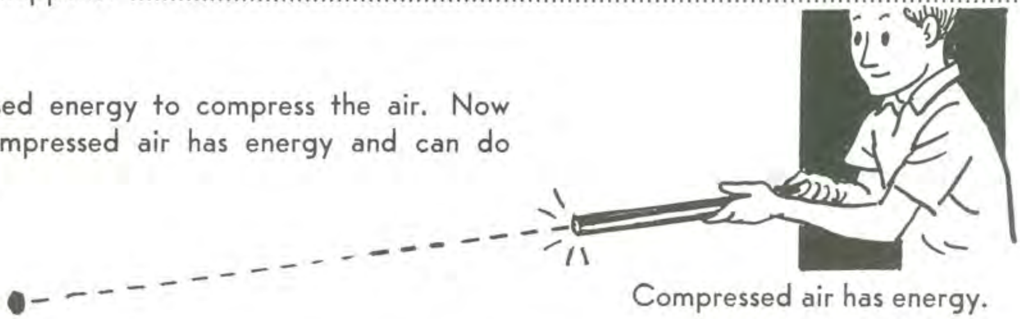
What happens? ....

The compressed air pushed the handle back again.

EXPERIMENT A5. Press a small piece of plasticine over the outlet and push the handle in slowly.

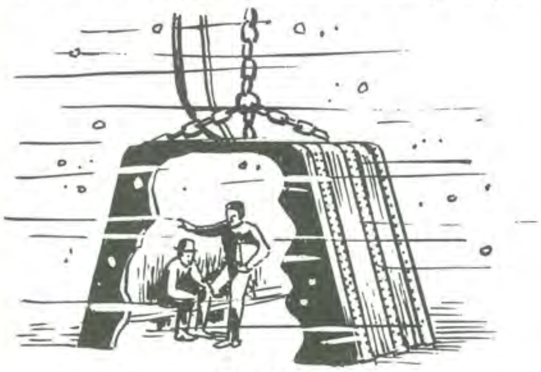
What happens? ....

You used energy to compress the air. Now the compressed air has energy and can do work.

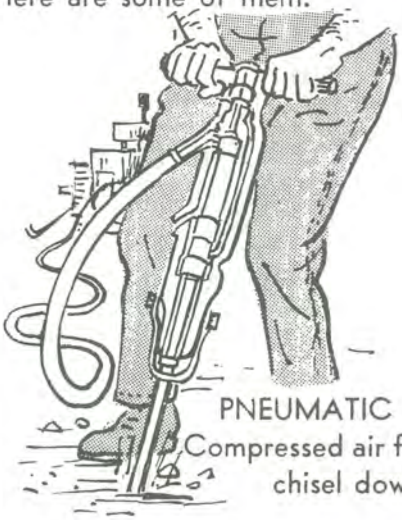


Compressed air has energy.

We use compressed air in many ways. Here are some of them.



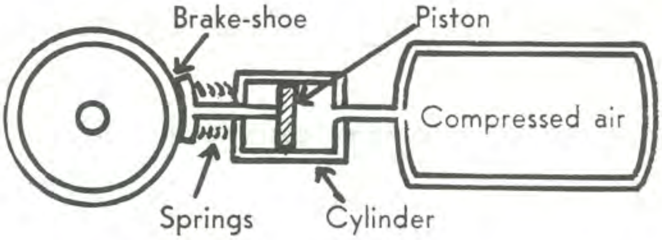
DIVING BELL
Compressed air keeps the water out of the diving bell.



PNEUMATIC DRILL
Compressed air forces the chisel down.

SPRAYING INSECTS

We pump air into the container and as it escapes through a fine hole it carries the spray with it.



AIR BRAKES

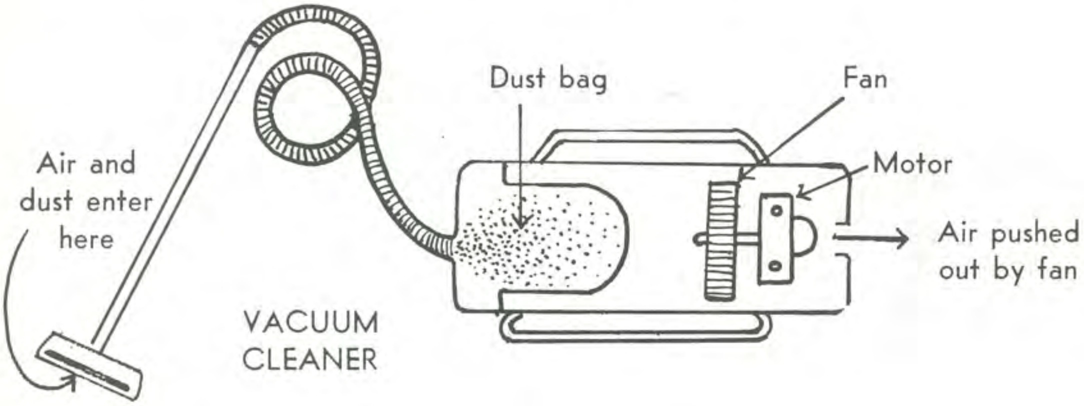
In air brakes, compressed air pushes the piston and forces the brake-shoe onto the wheel. Springs pull the shoe off when the brakes are released.

USING LOW PRESSURE AIR

EXPERIMENT A6. (Some of you will have done this one before.) Light a small crumpled piece of paper and drop it into a tall jar. Quickly stretch a piece of balloon rubber over the mouth of the jar. What happens to the balloon?

The air pressure in the jar is reduced and the atmosphere pushes the balloon in.

We use low air pressure in vacuum cleaners and milking machines.



VACUUM CLEANER

The motor drives a fan which pushes air out and lowers the pressure. Air from the atmosphere rushes in, carrying dust with it. The dust is trapped in the bag.

PICTURES IN ROCKS

You may have wondered how we know about animals which disappeared millions of years before man lived on Earth?

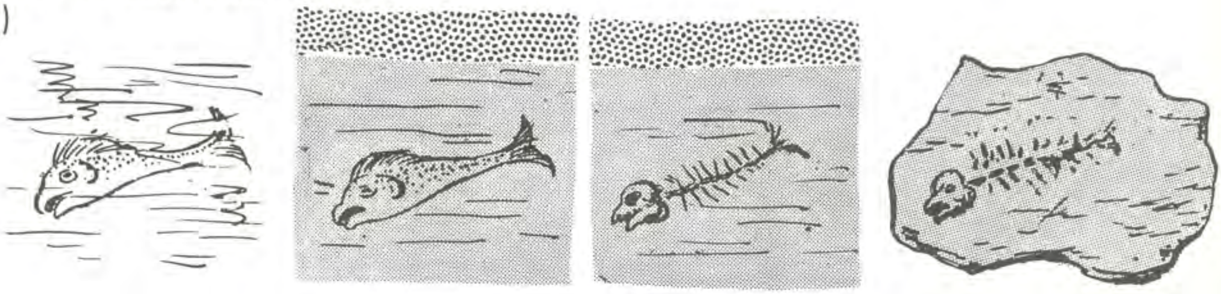
We learn much from FOSSILS.

Sometimes when an animal died its body was buried in the mud. The mud was pressed into rock and the hard parts, such as bones, teeth and shells remained embedded in the rock. Whole skeletons of dinosaurs have been found and put together by scientists.

Sometimes a leaf was pressed into the mud and was covered up. The leaf rotted away but the impression remained. Impressions of animals' feet have also been found.

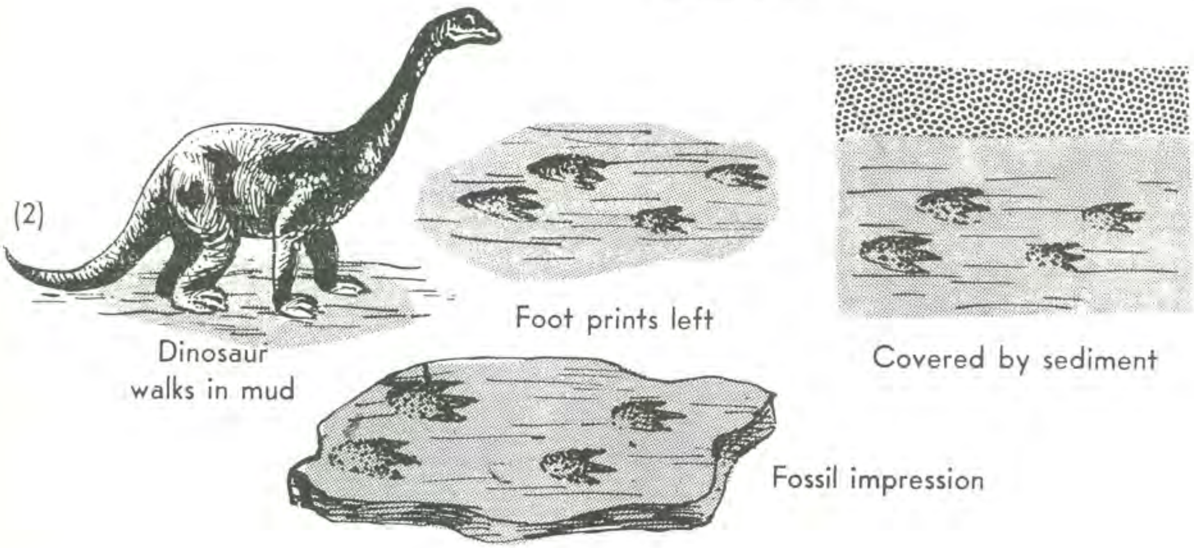
HOW FOSSILS ARE FORMED

(1)



Animal dies — Body is buried in mud — Soft parts decay and are pressed under sediment — Fossil

(2)



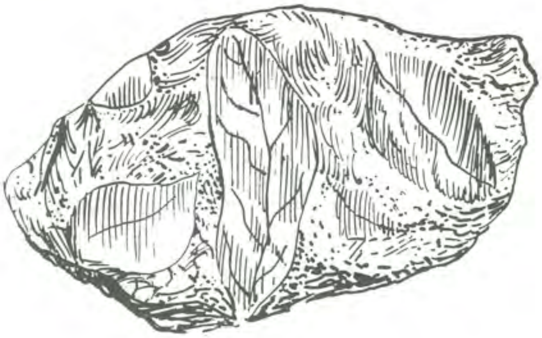
Dinosaur walks in mud

Foot prints left

Covered by sediment

Fossil impression

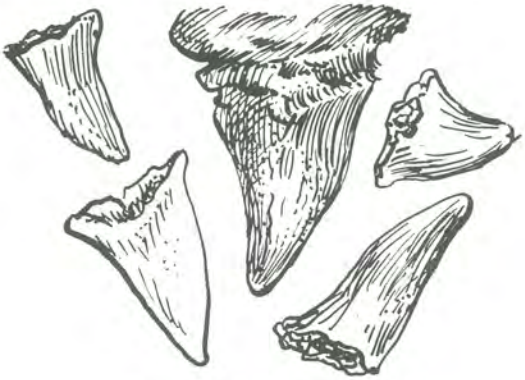
FOSSILS



Leaf impression in coal

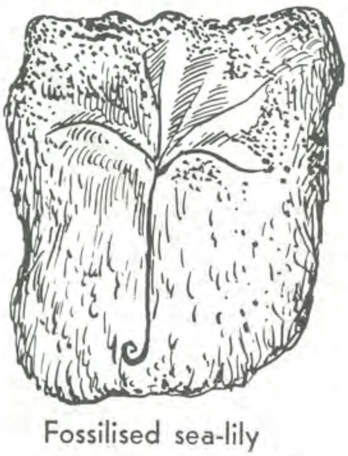
Skeleton of reptile in limestone

Fossil insect in amber
[amber is fossilised tree gum]



Fossilised sharks' teeth

Petrified wood



Fossilised sea-lily

Look for fossils in limestone, shale, coal or sandstone.

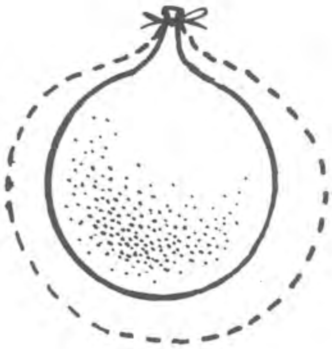
HEAT MAKES GASES GROW BIGGER

You may have done this experiment before.

EXPERIMENT H1. Blow up a balloon till it just takes shape. Tie the neck and place the balloon in front of a fire or radiator.

What happens? ....

The air took in heat energy and EXPANDED.



It pushed the walls of the balloon outwards.

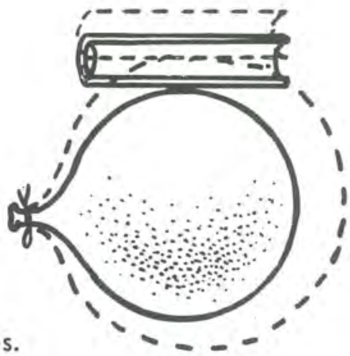
Because it had energy it could do work.

EXPERIMENT H2. Let the balloon cool.

Rest a light book on it and warm it again.

What does it do to the book? ....

....



The expanding air can lift the book.

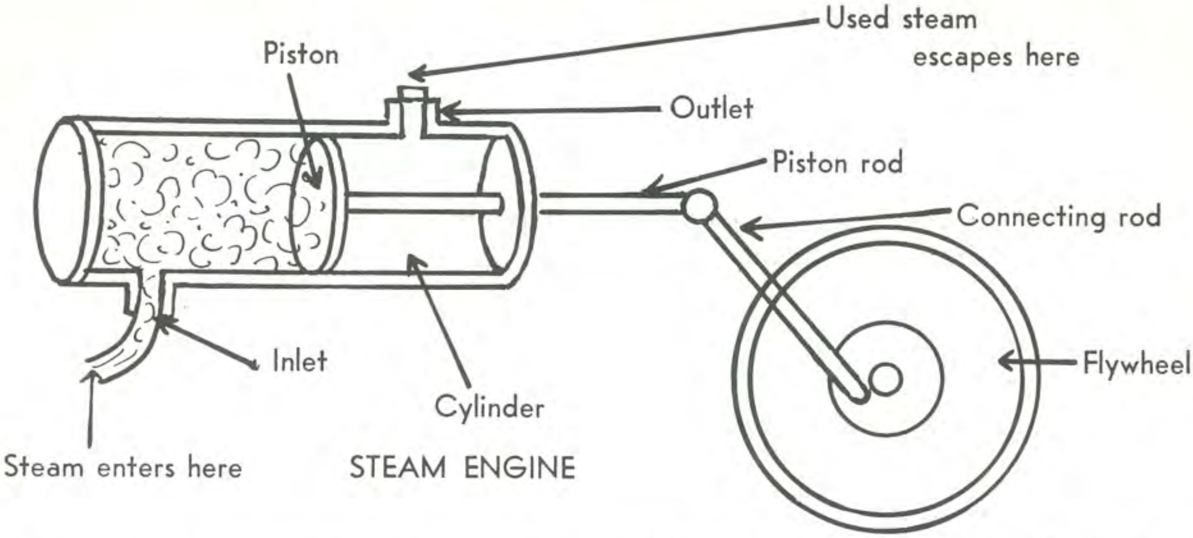
All gases expand when heated.

We use the energy of expanding gases to drive machines.

We use STEAM, PETROL VAPOUR, KEROSENE VAPOUR, as well as AIR.

How a steam engine works.

Steam enters the CYLINDER through the inlet valve. It pushes the piston along the cylinder. The piston rod pushes the flywheel round. The flywheel drives the wheels. As the flywheel moves round it pushes the piston back in place ready for more steam. The used steam escapes through the escape valve when the piston has moved past it.



STEAM ENGINE

This is only a very simple drawing of the real thing. Most steam engines have steam entering the cylinder first on one side and then on the other so that the piston is pushed backward and forwards by steam.

A petrol engine uses a mixture of petrol vapour and air. This is exploded by a spark from a spark plug. The expanding gases push a piston. The piston rod turns a crank-shaft.

Diesel engines use kerosene vapour or the vapour from a heavy oil. The mixture is exploded by hot compressed air. There is no spark plug.

Read more about these engines in a book from the Library.

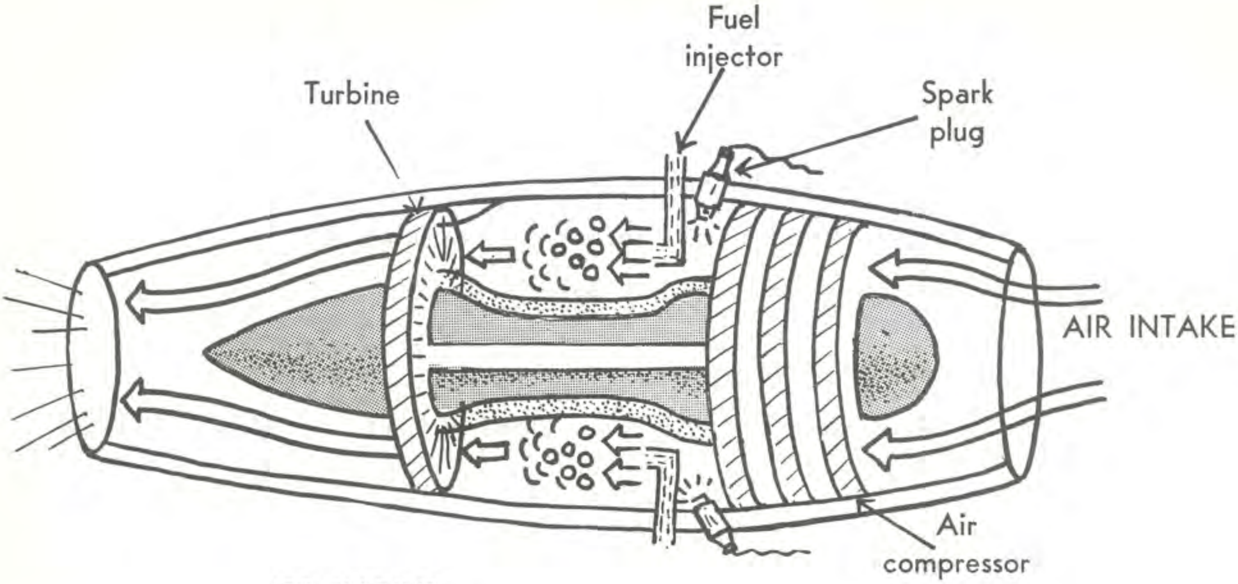
Now we need your balloon again.

EXPERIMENT H3. Blow the balloon up again but do not tie the neck. Just hold it so that the air cannot escape. Warm the balloon till it expands and then let it go.

What happens?

The expanded air rushing out of the nozzle makes the balloon move in the opposite direction.

This is really the way a jet engine works.



JET ENGINE

Air is taken in from the front of the aeroplane. It is compressed by the compressor. Heating is started by the spark plug. Fuel is sprayed in. The fuel is usually kerosene. The air and kerosene vapour burn fiercely. The expanded gas rushes out at the back of the jet and pushes the plane along. As it rushes out it turns the turbine which drives the compressor.

EXPLOSIONS

If things burn very rapidly and the gases expand very rapidly there is an explosion.

When a cracker explodes the chemicals inside burn rapidly and fiercely. The gases have to expand so they blow the case apart.

Shells, bombs, cartridges, bullets and detonators contain VERY DANGEROUS CHEMICALS. A knock can start them burning. LEAVE THEM ALONE.

Even if they look harmless LEAVE THEM ALONE.

If you find any tell your father, a policeman or some other adult and he will arrange for them to be disposed of.

HEATING OUR HOUSES

Do you remember the three ways that heat travels?

Conduction. Heat travels through the object.

Convection. The heated particles of a liquid or a gas move upward.

Radiation. Heat rays are given out by a hot object.

How does an electric radiator warm a room? ....

When does a radiator warm you most? When you stand in front? at the side? behind?

....

What is placed just behind the heating coils? ....

What does this do to the heat? ....

....

How does this heat reach you? ....

The heat rays are reflected. You are warmed by RADIATION.

Hold your hand over the top of the radiator. Can you feel the hot air rising? ....

In many radiators the cold air enters from the back and is warmed by the coils. Then it rises through holes in the top of the radiator. So a radiator warms by

as well as ....

Gas radiators work in a similar way.

How does an open fire warm a room?

Is an open fire a very good way of warming a room?

Give reasons for your answer.
(Think where much of the warm air goes.)

Some buildings have Central Heating.

There is a furnace in the lower part of the building which heats air or water.

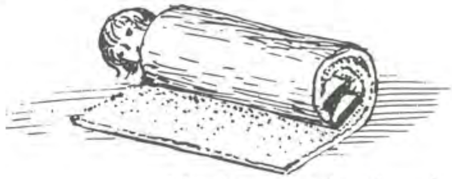
The heated air or water is carried by pipes to various parts of the building.

Why is the furnace placed at the bottom of the building?

DEALING WITH FIRES

Never stand close to a fire or a radiator. Your clothes may catch fire.

Don't stand near radiators



Rug

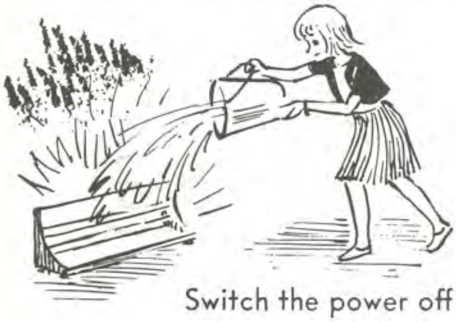
Lie down and roll up in rug

If your clothes do catch fire lie down and roll over and over. If there is a rug handy, roll yourself in it. This will put out the flames. Why? ....

....

Never hang clothes on a radiator to dry.

If something electrical causes a fire, switch off the power before throwing water on the fire. Otherwise you may receive a shock.



Switch the power off first.

Put sand on oil or petrol fires

NEVER put water on burning petrol or oil. You will only spread the fire. Can you think why this would happen? ....

....

Use a fire-extinguisher or cover the fire with dirt or sand.

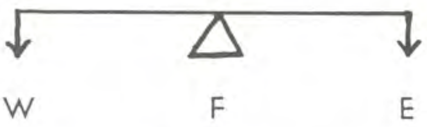
What number do you ring to get the FIRE BRIGADE? ....

Always make sure your picnic fire or camp fire is out before you leave. Cover it with dirt.

MORE ABOUT LEVERS

The boy is using the stick as a   to help him lift the stone.

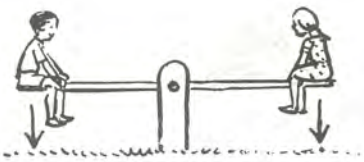
In a diagram it looks like this.



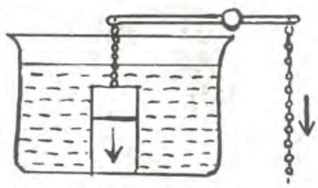
E is the effort used
W is the weight moved.
F is the fulcrum or supporting point.

This is a FIRST ORDER lever. The fulcrum is between the weight and the effort.

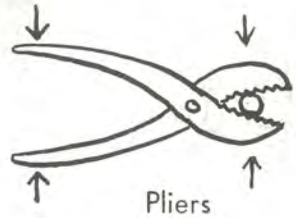
Here are some First Order levers. Mark E, W, F in each case.



See-saw

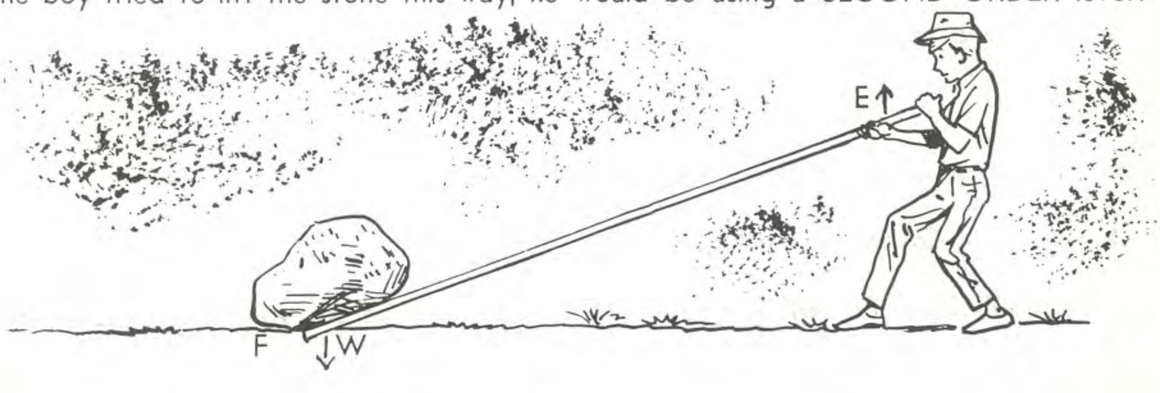


Toilet cistern

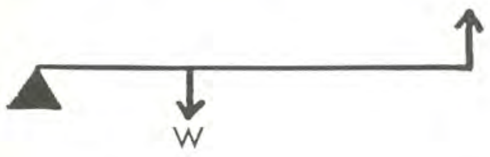


Pliers

If the boy tried to lift the stone this way, he would be using a SECOND ORDER lever.

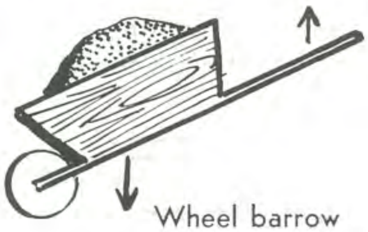


In a diagram it would look like this:

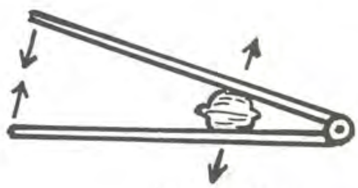


The fulcrum is at one end and the weight is closer to the fulcrum than the effort is.

Here are some Second Order levers. Mark E, W, F in each case.

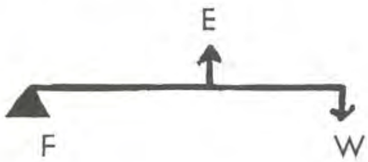


Wheel barrow



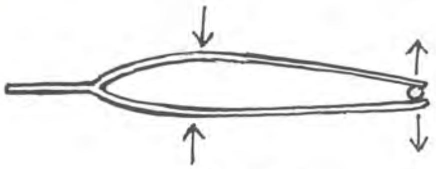
Nutcrackers

The THIRD ORDER levers look like this:

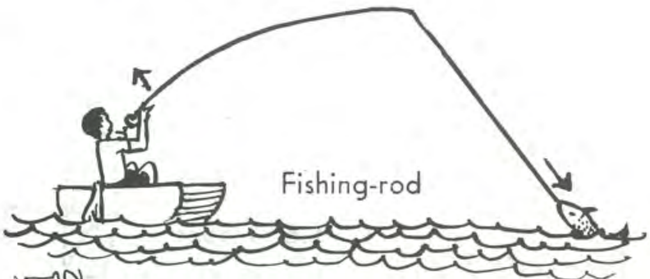


The fulcrum is at one end and the effort is closer to the fulcrum than the weight is.

Here are some Third Order levers. Can you mark F, W, E on these?

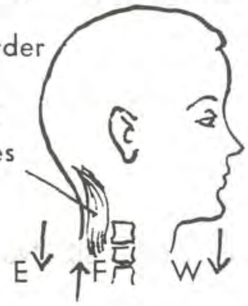


Tweezers



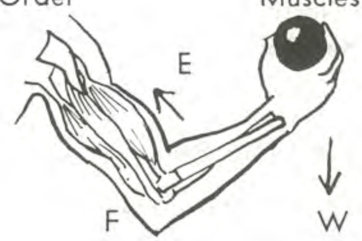
Fishing-rod

Your body moves by various levers.



Nodding your head

Rising on your toes



Moving your forearm

WINDS

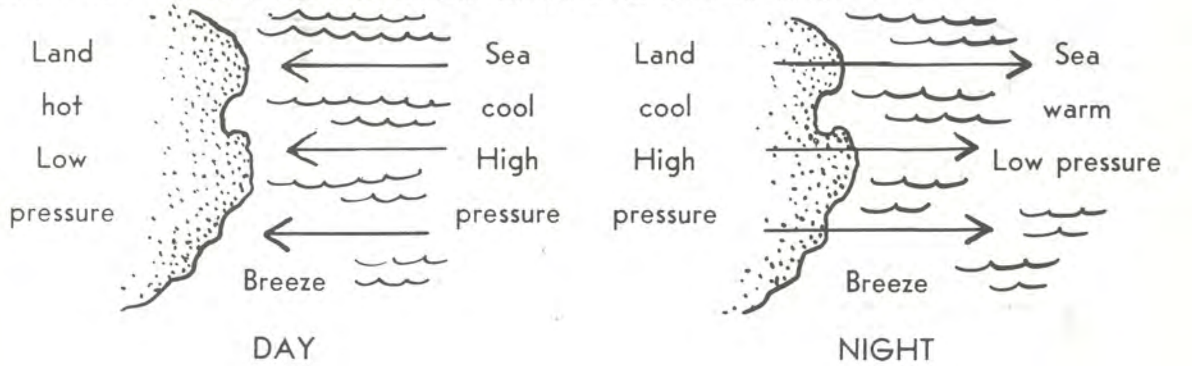
Winds are   air.

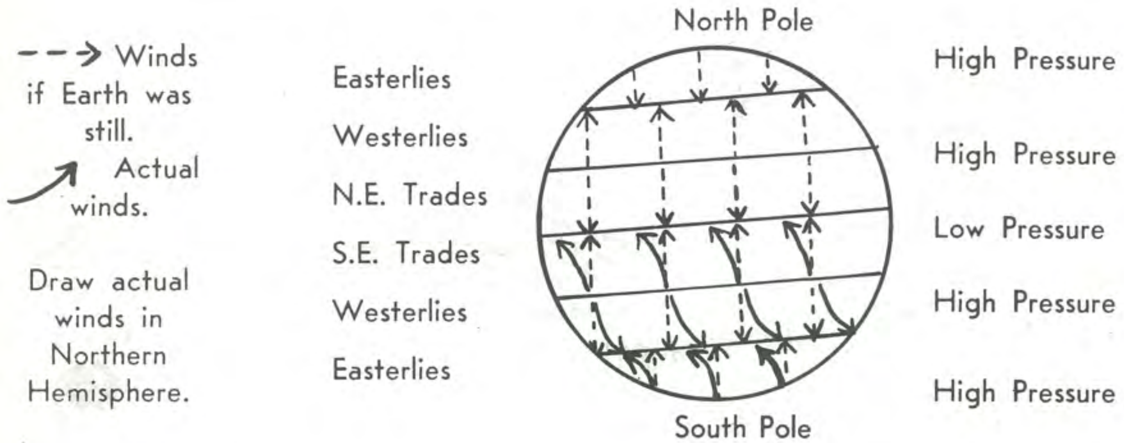
Winds blow from areas of HIGH PRESSURE to areas of LOW PRESSURE.

Heat makes air expand and become lighter. It rises, and cool air blows in to take its place.

LAND AND SEA BREEZES

During the day the land warms up faster than the sea. This means there is a low pressure area over the land. The breeze blows from the sea to the land. At night the land cools faster than the sea, and the breeze blows from land to sea.





World Wind Belts.

There is a low pressure area over the Equator, High Pressure Areas about 30° North and South Latitude and High Pressure Areas at the Poles.

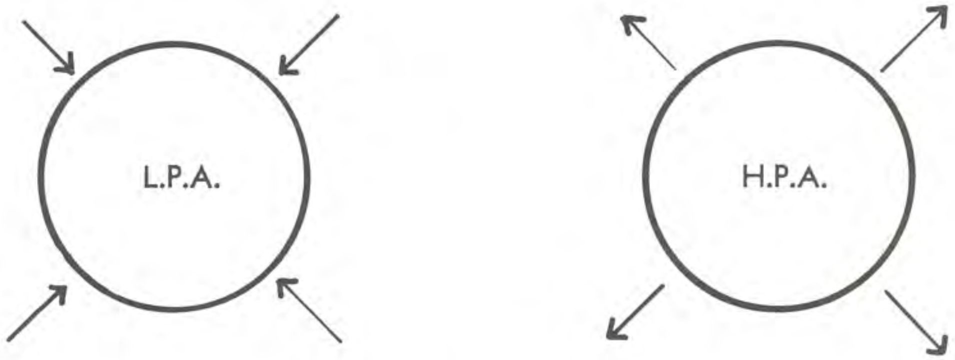
This gives a wind pattern of winds blowing alternately North and South.

If the Earth was still the winds would blow due North and South but the rotation of the Earth turns them to the Left in the Southern Hemisphere and to the Right in the Northern Hemisphere. Land masses also alter the direction of the winds.

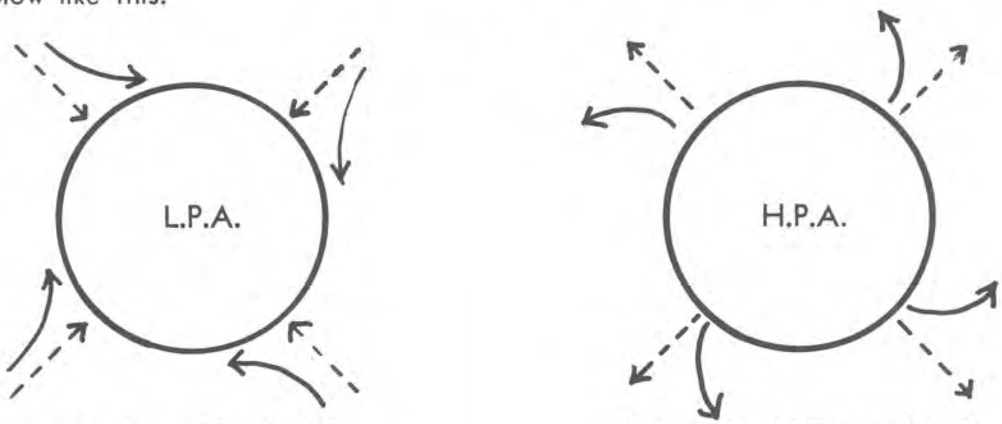
The wind pattern is also altered because High Pressure Areas and Low Pressure Areas are always moving across the Earth.

Winds blow towards a Low Pressure Area.
Winds blow from a High Pressure Area.

LOW PRESSURE AREA HIGH PRESSURE AREA



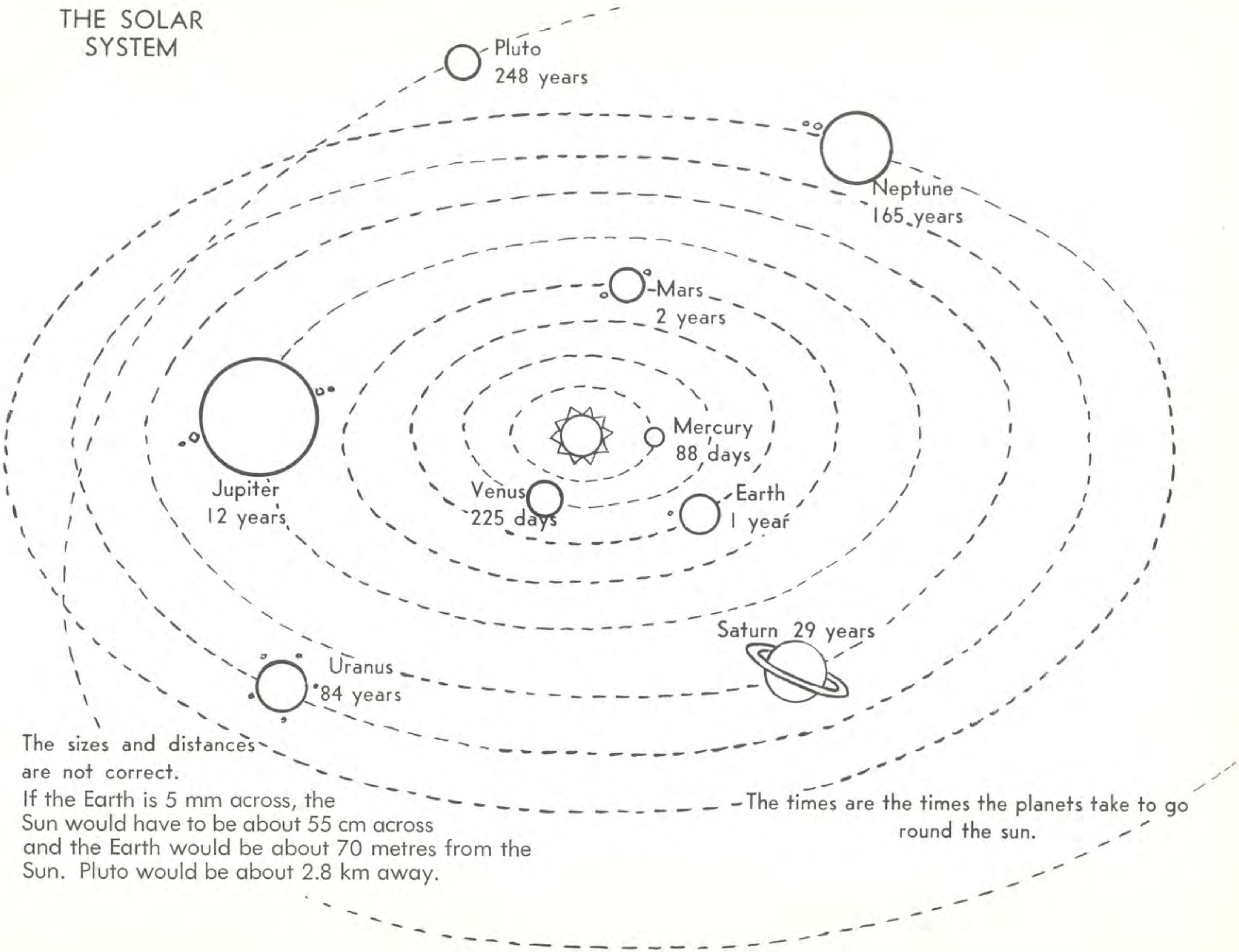
The rotation of the Earth turns the winds to the Left in the Southern Hemisphere so the winds blow like this.



This is a CYCLONE This is an ANTICYCLONE

Study the Weather Maps in the paper or on TV. Look for the HIGH and LOW pressure areas. Notice the way the winds blow. The numbered lines are called ISOBARS. They show places with equal pressure.

THE SOLAR SYSTEM



The sizes and distances are not correct.

If the Earth is 5 mm across, the Sun would have to be about 55 cm across and the Earth would be about 70 metres from the Sun. Pluto would be about 2.8 km away.

The times are the times the planets take to go round the sun.

THE SOLAR SYSTEM

The SOLAR SYSTEM is made up of the SUN, nine PLANETS and their MOONS, some smaller bodies, called ASTEROIDS, COMETS and METEORS.

The Sun is by far the largest body. It is about 1 500 000 km across. This is about ten times the diameter of JUPITER, the largest planet.

THE PLANETS.

Planet	Distance from Sun	Time to go round Sun	Diameter compared to Earth
Mercury	58 000 000 km	88 days	0.4
Venus	107 000 000 km	225 days	0.97
Earth	150 000 000 km	1 year	——
Mars	230 000 000 km	nearly 2 years	0.5
Jupiter	770 000 000 km	12 years	11.0
Saturn	1 420 000 000 km	29 years	9.5
Uranus	2 850 000 000 km	84 years	4.0
Neptune	4 750 000 000 km	165 years	3.5
Pluto	5 870 000 000 km	248 years	0.5

How many kilometres from Earth to Mars at the closest? ....

How many kilometres from Earth to Venus at closest? ....

Which pairs of planets are about the same size?

.... and ....; .... and ....;

.... and ....

How many miles from Earth to Mars at the closest? ....

How many miles from Earth to Venus at closest? ....

Which is the nearest planet to Earth? ....

LIFE ON OTHER PLANETS.

Life, as we know it, needs—
(a) oxygen (b) water (c) temperatures which are not too hot or too cold.

The only planets which could have our sort of life are VENUS and MARS. Venus is always covered by clouds so we don't know much about it. There may be some kind of life on MARS even if only plant life.

MERCURY is too (cold/hot) and the other planets are too ....

MOONS. Earth has .... moon. Mars has two, Jupiter has twelve, Saturn has nine, including one, Titan, which is about the size of MARS. Uranus has five and Neptune has two.

ASTEROIDS are tiny planets. The largest is 800 km in diameter.

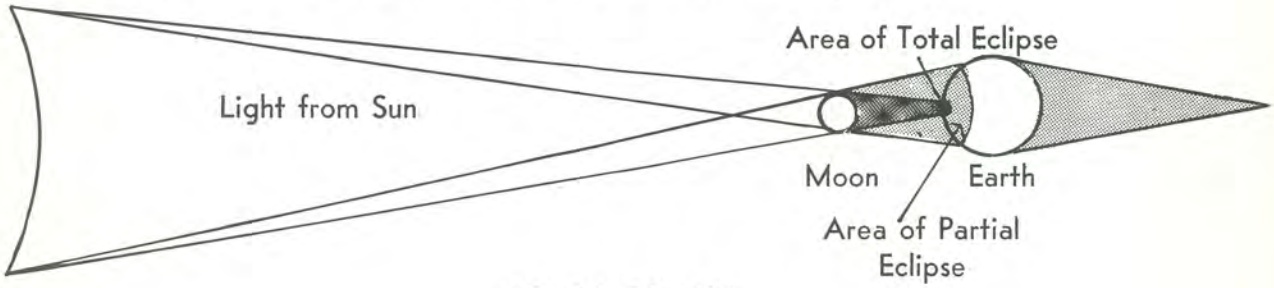
COMETS are made of dust and gas. They appear from space, circle the Sun in a short time and disappear. They have a head and a tail, which may be millions of kilometres long.

METEORS are pieces of stone or iron. As they pass through the atmosphere they glow. This gives them the name of "falling stars" or "shooting stars". Of course, they are not stars. Usually they burn up in the atmosphere. Sometimes they reach the Earth as METEORITES.

WHAT CAUSES ECLIPSES?

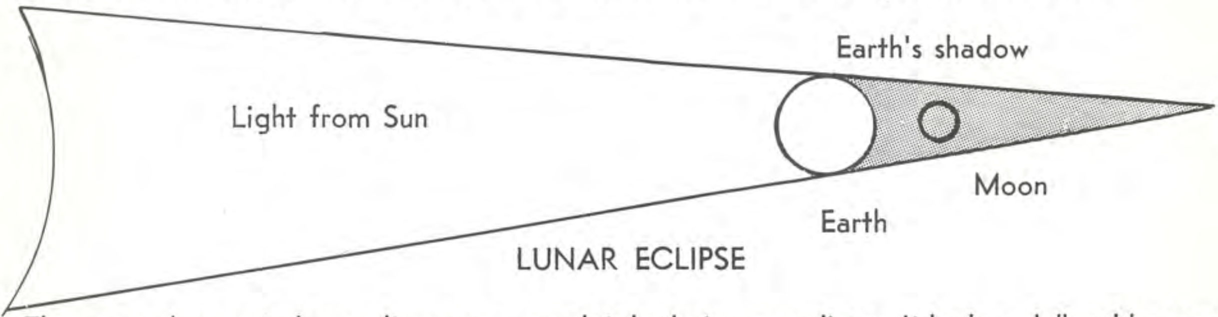
Everything that is lighted by something else has a shadow. This includes the Earth and the Moon which are lighted by the Sun. When the shadow of the Moon falls on the Earth there is an ECLIPSE of the Sun. The whole or part of the Sun is hidden.

As the Moon revolves round the Earth the area of the eclipse moves.



SOLAR ECLIPSE

If the shadow of the Earth falls on the Moon there is an eclipse of the Moon.



LUNAR ECLIPSE

The moon does not always disappear completely during an eclipse. It looks a dull red because some light is bent round the Earth.

PRESSURE IN LIQUIDS

EXPERIMENT PL1. Unscrew the handle from a bicycle pump. Put your finger over the outlet and fill the cylinder with water. Screw the handle on again. Try to push the handle in as you did when you compressed air.

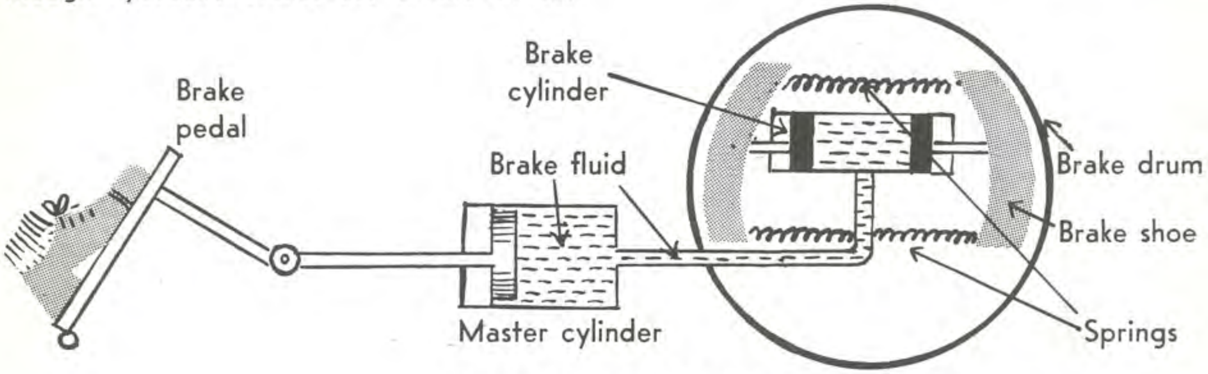
Can you do it? ....

It is practically impossible to compress liquids.

If you press a liquid in one place the pressure is passed on through the liquid in all directions.

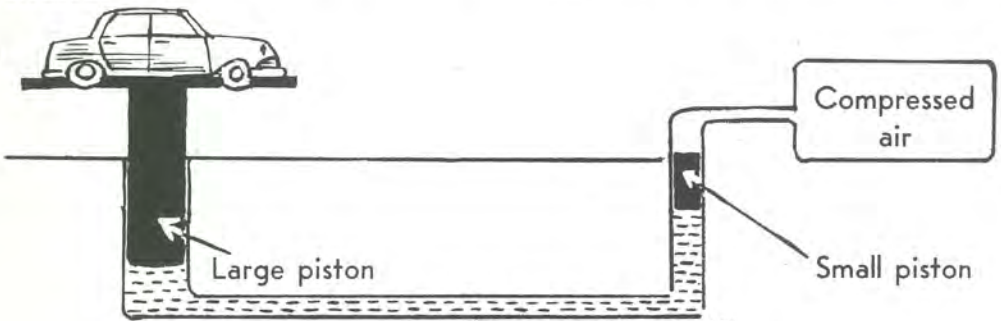
We use liquid pressure in various ways.

Most cars have HYDRAULIC brakes. Hydraulic is made from a word that means water, though hydraulic brakes use a kind of oil.



HYDRAULIC BRAKES

When you push the brake pedal, it pushes the piston in the master cylinder. The pressure is passed on by the brake fluid to the two pistons in the brake cylinder. These push the brake shoes against the brake drum. Springs pull the shoes off again when the brake is released.



HYDRAULIC HOIST

Compressed air is let in and pushes on the small piston. The pressure is passed on by the liquid and pushes up the big piston which lifts the car.

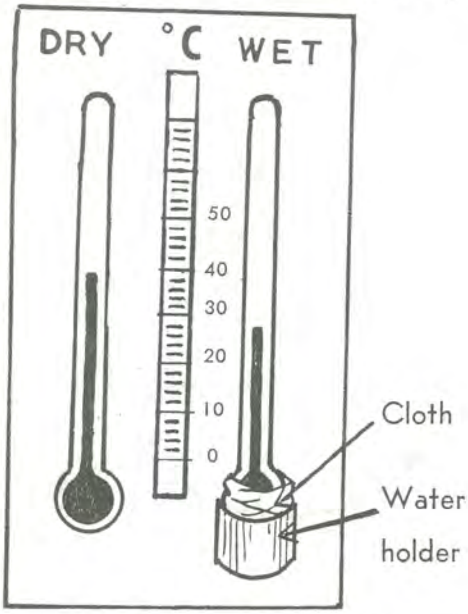
MEASURING HUMIDITY

Humidity means the amount of water vapour in the air.

When it is very humid there is a good deal of water vapour in the air.

It is useful to know how much water vapour there is because it helps us to forecast the weather.

One way of measuring humidity is by using a WET and DRY Thermometer.



Is the humidity high or low?

It is really two thermometers.

Cloth is wrapped round the bulb of one. The cloth is kept damp as it dips into water.

The cloth is kept cool because the water

....

If there is a good deal of water vapour in the air, evaporation will be slow and there will not be much cooling. The wet bulb thermometer will be nearly the same as the dry bulb thermometer.

If the air is dry, evaporation will be quick and there will be much cooling and the reading on the wet bulb will be much than the dry bulb.

If the reading on the wet bulb is nearly the same as the reading on the dry bulb, the humidity is (high/low).

If the reading on the wet bulb is much lower than the reading on the dry bulb, the humidity is (high/low).

There are tables which tell the percentage of humidity for any temperature readings.

There may be one at your school.

Answer these questions.

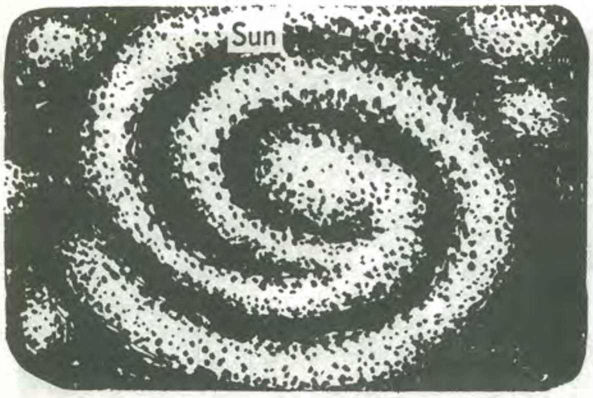
Do clothes dry better on a cold dry day or a warm humid day? ....

Why do your clothes "stick" to you on a humid day? ....

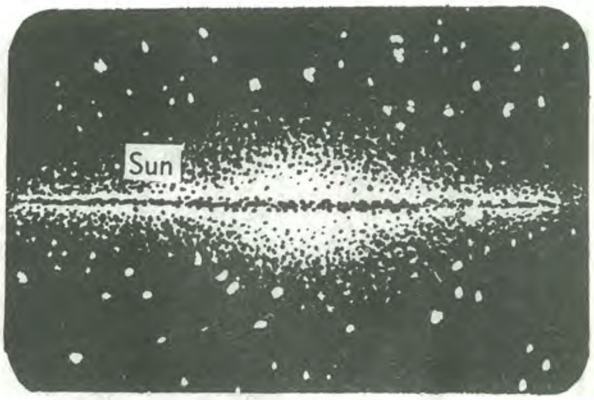
....

THE MILKY WAY

On a clear night you can see an uneven misty band of light stretched across the sky. This is the MILKY WAY. It is made of an enormous number of stars in a shape like these pictures.



Looking down on it



Looking at it sideways

OUR GALAXY

The Milky Way is a collection of 100,000 million stars called a GALAXY. When we look through the Galaxy towards the centre we see it as a band of light.

Our Sun is one star in the Galaxy. There are bigger and smaller stars than the Sun in our Galaxy.

The UNIVERSE is made up of millions of galaxies. Some of these are so far away that they look like tiny hazy spots of light even with the most powerful telescopes. We believe that there are galaxies which are too far away for us to see. As far as we know the galaxies go on for ever.

MEASURING DISTANCE

Distances in space are so great that if we measured them in kilometres the numbers would be too large to write.

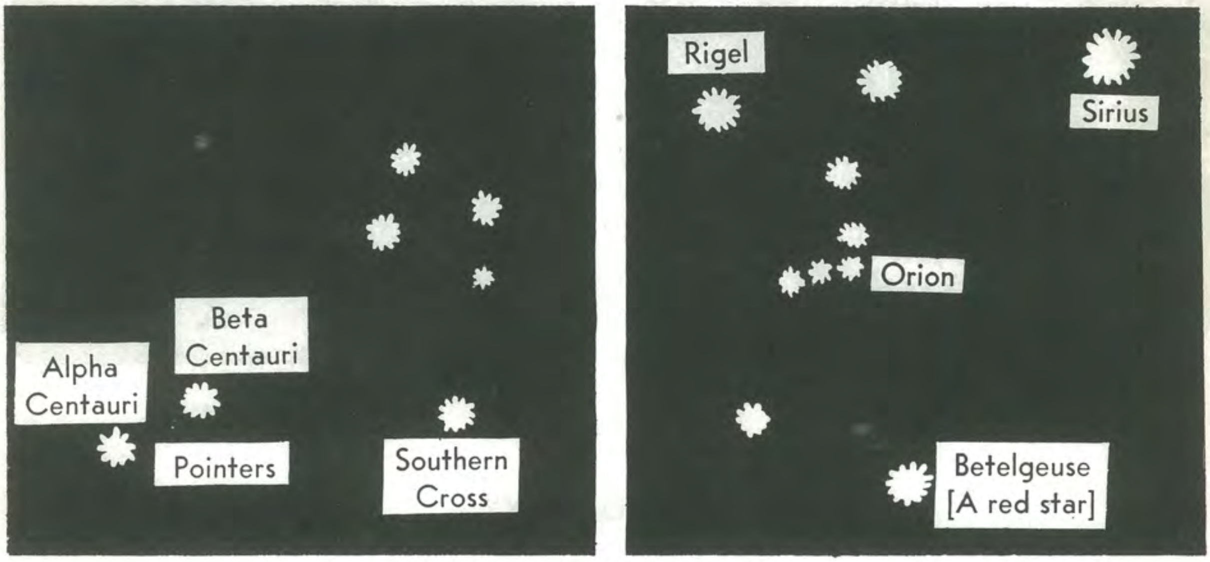
Instead of miles we use a DISTANCE called a LIGHT YEAR. This is the distance light would travel in one year. Light travels at 300 000 km a second.

So a Light Year $= 300\,000 \times 60 \times 60 \times 24 \times 365$ kilometres.

Work it out. ....kilometres.

The Sun is 150 million kilometres from the Earth. It takes light 8 minutes to travel that distance so the Sun is eight light minutes from the Earth.

The next nearest visible star is ALPHA CENTAURI. This is the pointer that is furthest away from the Southern Cross. It is $4\frac{1}{3}$ light years away.



SIRIUS, the Dog Star, and the brightest star in the sky, is about 8 light years away. Our galaxy is 100,000 Light Years across. It takes 5,000,000,000 years for light from the stars in some distant galaxies to reach us.

This will give you some idea of the size of the Universe.

Our Earth is a tiny speck in a vast universe. Yet on this tiny speck live people who can look at, measure and think about this Universe.

MEASURING TIME

You learnt earlier that a day is the time it takes for one rotation of the ....

The time of rotation was checked by observing the sun. Now it is checked by observing the stars. This is called SIDERIAL (star) time.

The main time centre for Australia is Mount Stromlo Observatory in Canberra. It has clocks which are kept accurate to one second in three years. Time signals are sent to radio and TV stations and to ships at sea.

EXPLORING THE OCEAN DEPTHS

One part of our world has scarcely been explored at all.

This part is the deep ocean. Why? ....

....

The under-water explorer must not only have some way of breathing under water but also he must be able to stand the pressure of the water.

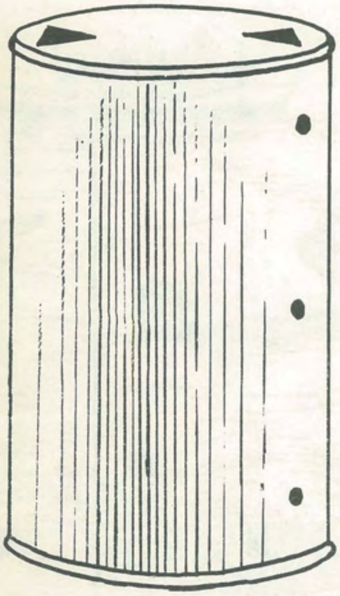
EXPERIMENT. With a sharp nail, punch three holes in a tin. A soft-drink can will do well One hole should be about 3 cm from the top, one half-way down and the third near the bottom. Cover the holes with plasticine and fill the tin with water. Remove the plasticine and watch how the water comes out of the holes.

(a) Out of which hole does the water shoot furthest? ....

(b) Out of which hole does it shoot the least distance?..

(c) Where is the water pressure greatest?

....



Show how the water spurts out of the three holes?

Water-pressure increases with depth.

You may remember that the pressure of the Atmosphere is about 1 kg per square centimetre. Water pressure increases about 1 kg per square centimetre for each 10 metres of depth. What would be the total pressure (air and water) at a depth of 40 metres? ....

At 1 km down the pressure is about 0.1 tonne to the square centimetre.

Divers who dive deep down under the water must be protected against the pressure. Experienced skin-divers can dive to 30 metres. Divers in ordinary diving suits can reach 100 metres. With special metal suits they can reach 250 metres. To go deeper than this, special **apparatus is needed.**

In 1934 Dr. Beebe, an American, descended over 1000 metres in a steel ball 1.5 metres across, called a BATHYSPHERE.

In 1960 a depth of about 11 000 metres was reached in a machine called a BATHYSCAPHE.

FIND OUT: Who? .... **Where?** ....

The pressure at this depth? .... kg per sq. cm